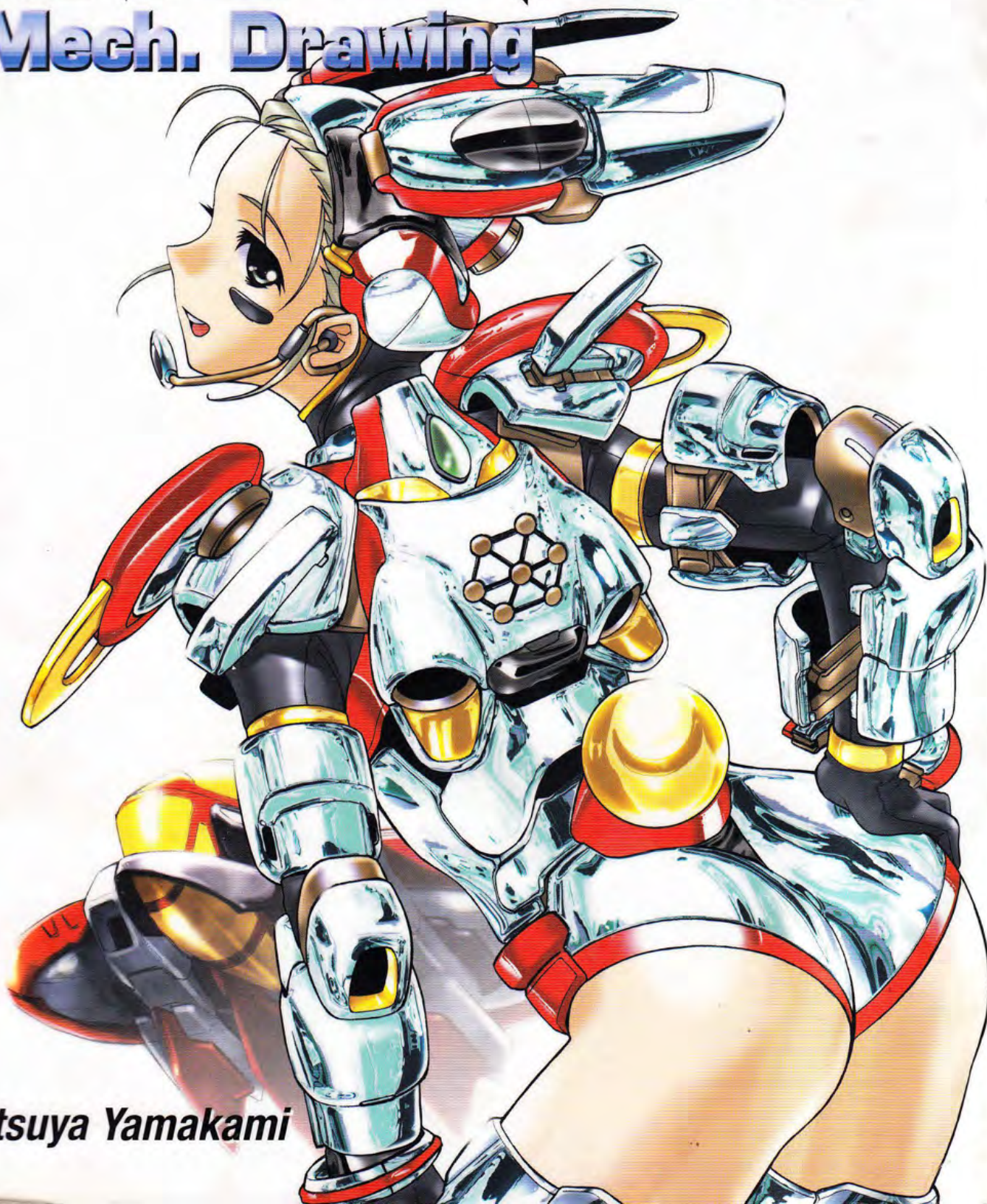


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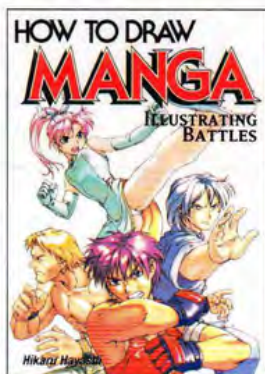
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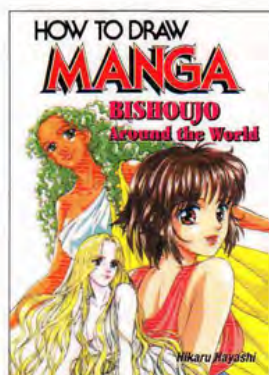
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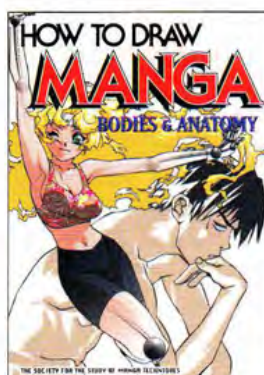
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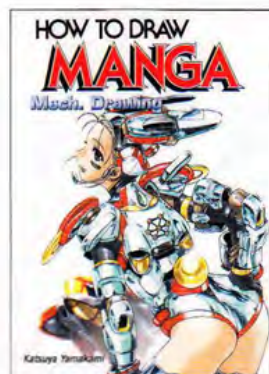
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# HOW TO DRAW **MANGA**

*Mech. Drawing*



HOW TO DRAW MANGA:  
Mech. Drawing  
by Katsuya Yamakami

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This book was first designed and published in 2002 by Graphic-sha Publishing Co., Ltd.  
This English edition was published in 2003 by Graphic-sha Publishing Co., Ltd.  
1-14-17 Kudan-kita, Chiyoda-ku, Tokyo 102-0073 Japan

Artwork:	Suguru Matsumoto, Kitaro, Ryo Yuki, Maasa, Mao Nishinohara, Katsuya Yamakami
Cover Drawing:	Kazuaki Morita, Akaza
Production Assistance:	K's Art
English Title Logo Design:	Hideyuki Amemura
English Edition Layout:	Shinichi Ishioka
English Translation Management:	Língua franca, Inc. (an3y-skmt@asahi-net.or.jp)
Japanese Edition Editor:	Motofumi Nakanishi (Graphic-sha Publishing Co., Ltd.)
Foreign Language Edition Project Coordinator:	Kumiko Sakamoto (Graphic-sha Publishing Co., Ltd.)

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First printing: December 2003

ISBN: 4-7661-1334-9  
Printed and bound in China by Everbest Printing Co., Ltd.



# HOW TO DRAW **MANGA**

*Mech. Drawing*



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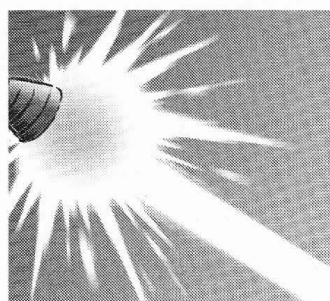
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# About This Book

It seems that many artists find portraying mecha (machines) a difficult task. When I asked around, I found the most common problem was maintaining a logical physical form when drawing, followed by either getting the drawn machines to look satisfyingly "mechanical" or getting metallic parts to look convincing. Most of those I surveyed gave me evasive answers and seemed just to assume the topic was too difficult in the first place.

But, is that truly the case?

In this volume, I focused on the fact that mecha have only four different textures: metal, plastic, glass, and rubber. Once you have learned the tricks to depicting these textures, all you have to worry about is how to represent a three-dimensional mechanical object. I discovered a five-step representation process for drawing three-dimensional machines simply and easily, which I also explain in this book.

**Machines come in four textures**

**+**

**Their forms can be portrayed using a five-stage representation process**

Not only that, but if we further group the construction of mecha into either those that run or those that fly, then you will find yourself improving so rapidly that you will wonder how you ever let yourself be intimidated.

Once you have reached that level, try connecting a few of your own ideas to design your own, original mecha. Rest assured, I have also included a few tips that are effective for getting these machines to look extra slick.

# Chapter 1

## Tricks to Depicting "Metallic" Textures





# Machines Can Be Depicted Using Four Textures

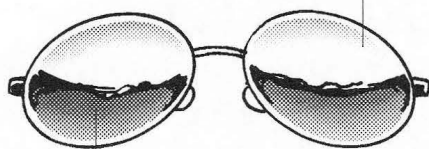


# 1

## Metal (Chrome)

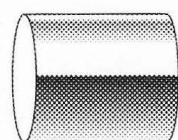
Sunglasses

The sky

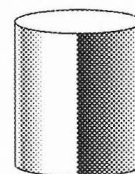


The ground

Chrome-plated sunglasses make a good example for how to portray a metallic texture. The object reflects its surroundings like a mirror.



Strong reflections using solid black

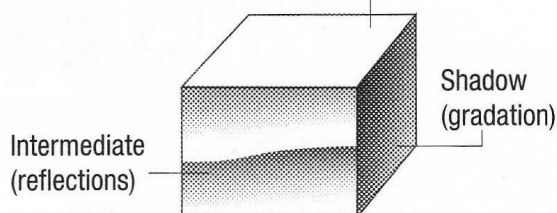


Adding a gradation tone with solid black starting from the center (part closest to the picture plane) creates the look of chrome.

Light source



Lit area (no shading added)



Intermediate (reflections)

Shadow (gradation)

A satisfying look is created by leaving lit areas white and using a dark gradation tone in areas in shadow, while adding reflections in two levels to the intermediate surface.

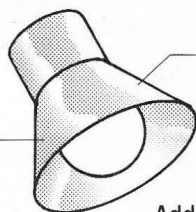


# 2

## Plastic

Lampshade

Light source

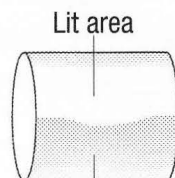


Lit area

Reflected light

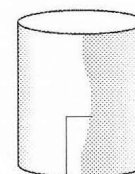
Add in lightly reflections of the surroundings.

Depiction of plastic is similar to that of metal. However, in order to show the lightness of plastic, avoid adding solid black, and instead use a light gradation tone.



Lit area

Reflections



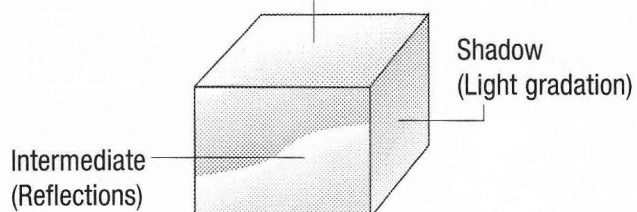
Wave

Unlike the hard silhouette of chrome objects, the sense of luster in plastics can be created by adding intentional waves to the surfaces.

Light source



Lit area (Gradation fading to white)



Intermediate (Reflections)

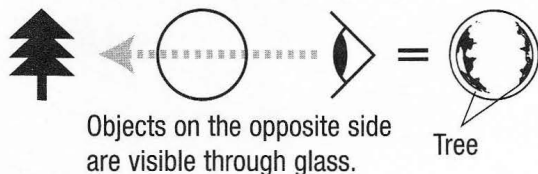
Shadow (Light gradation)

Unlike with chrome objects, a sense of luster can be created by adding a light gradation tone.



# 3

## Glass



Objects on the opposite side are visible through glass.

Tree



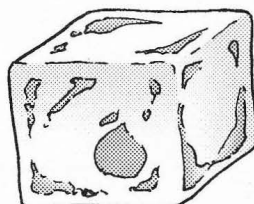
The scene is distorted and pushed to the perimeter of the glass.



Rendering scenes viewed through glass as distorted will enhance the feel of glass.



Light source



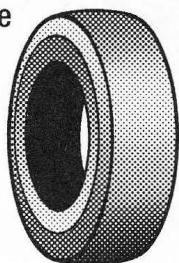
Picturing the effects of ice will make this concept easier to understand.



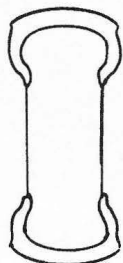
# 4

## Rubber

Tire

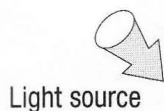


Light source



Cross-section

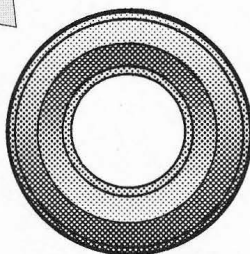
Shadow



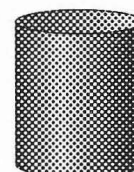
Light source

Dark

Light



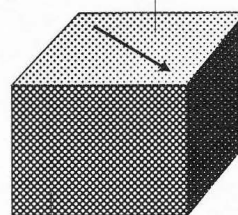
Rubber has a matte black finish, so avoid using white highlights and stick with large dot screen tones.



Use 20% grey screen tone for the lightest areas and a 100% large-dot gradation tone for shadowy areas to generate the appropriate feel.



Lit area (30%→10% gradation)



Shadow (Solid black)

Intermediate area (60% grey screen tone)

## Summary

### Screen Tone Numbers

1. For metal → the key is to show the surrounding environment reflecting off the object's surface \_\_\_\_\_ 60's and 70's series
2. For plastic → the trick is to use light screen tones and highlights skillfully \_\_\_\_\_ 60's and 70's series
3. For glass → the key is to draw the scene from the other side around the perimeter of the glass surface \_\_\_\_\_ 60's and 70's series
4. For rubber → the key is to avoid adding highlights, but instead to render the object overall in dark tones \_\_\_\_\_ 40's and 50's series

With respect to screen tone, higher numbers (greater, finer dots) generate more of a sheen, while lower numbers (less, larger dots) produce more a matte tone.



## ● Drawing Machines Using the Four Textures

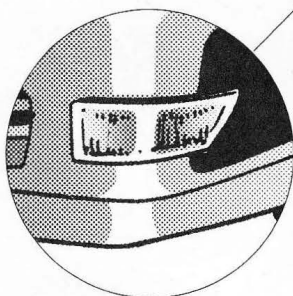
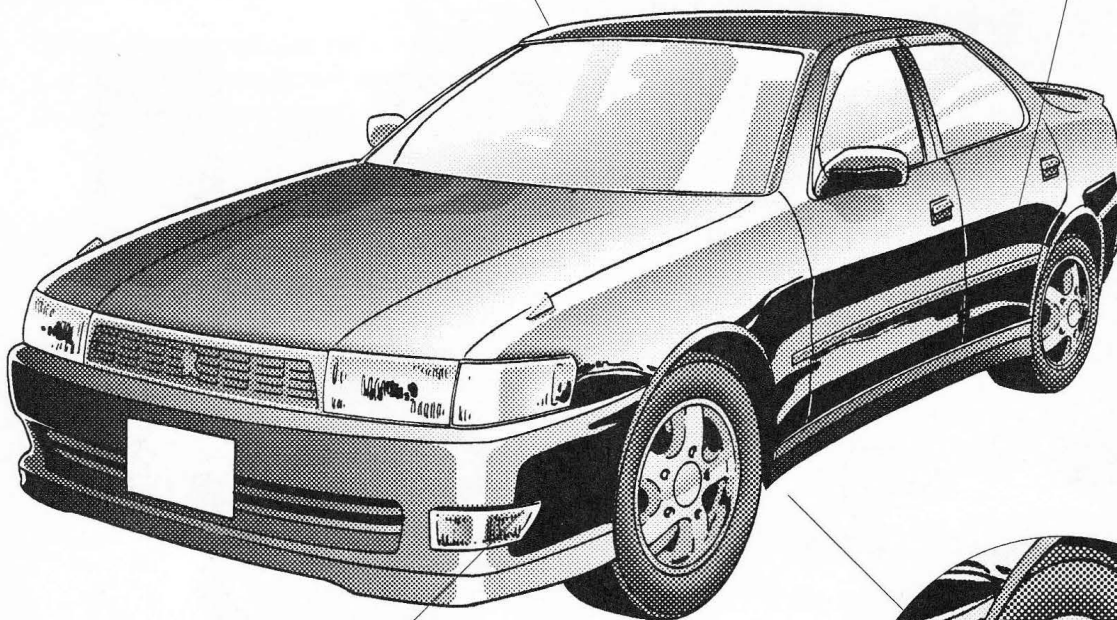
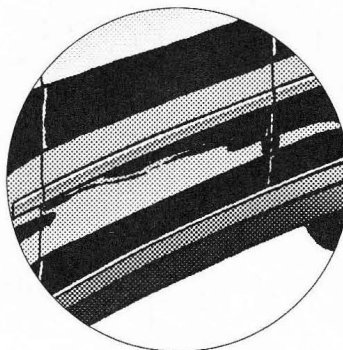
### Glass (Front Windshield)

Use light gradation tone for the interior and add strong highlights to curved lines to create the look of glass.



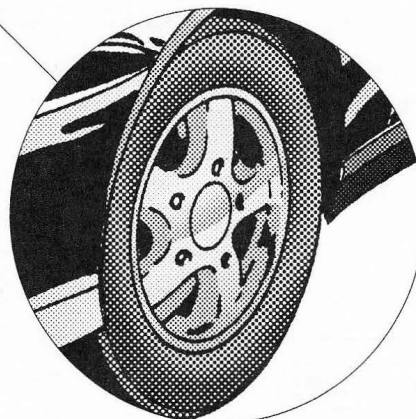
### Metal/Body Paint

Add solid blacks for reflections and light screen tone to generate a metallic luster.



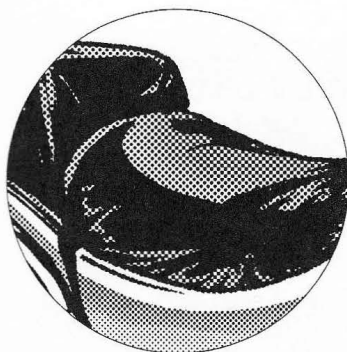
### Plastic (Turn Signal Indicator)

Sketch in the region seen from underneath the cover shield and add screen tone to create the look of colored plastic.



### Rubber (Tire)

Avoid adding white highlights and instead use large-dot, dark screen tones to create a matte finish.

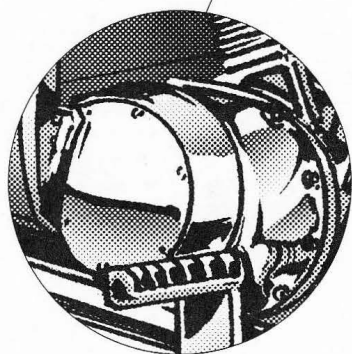
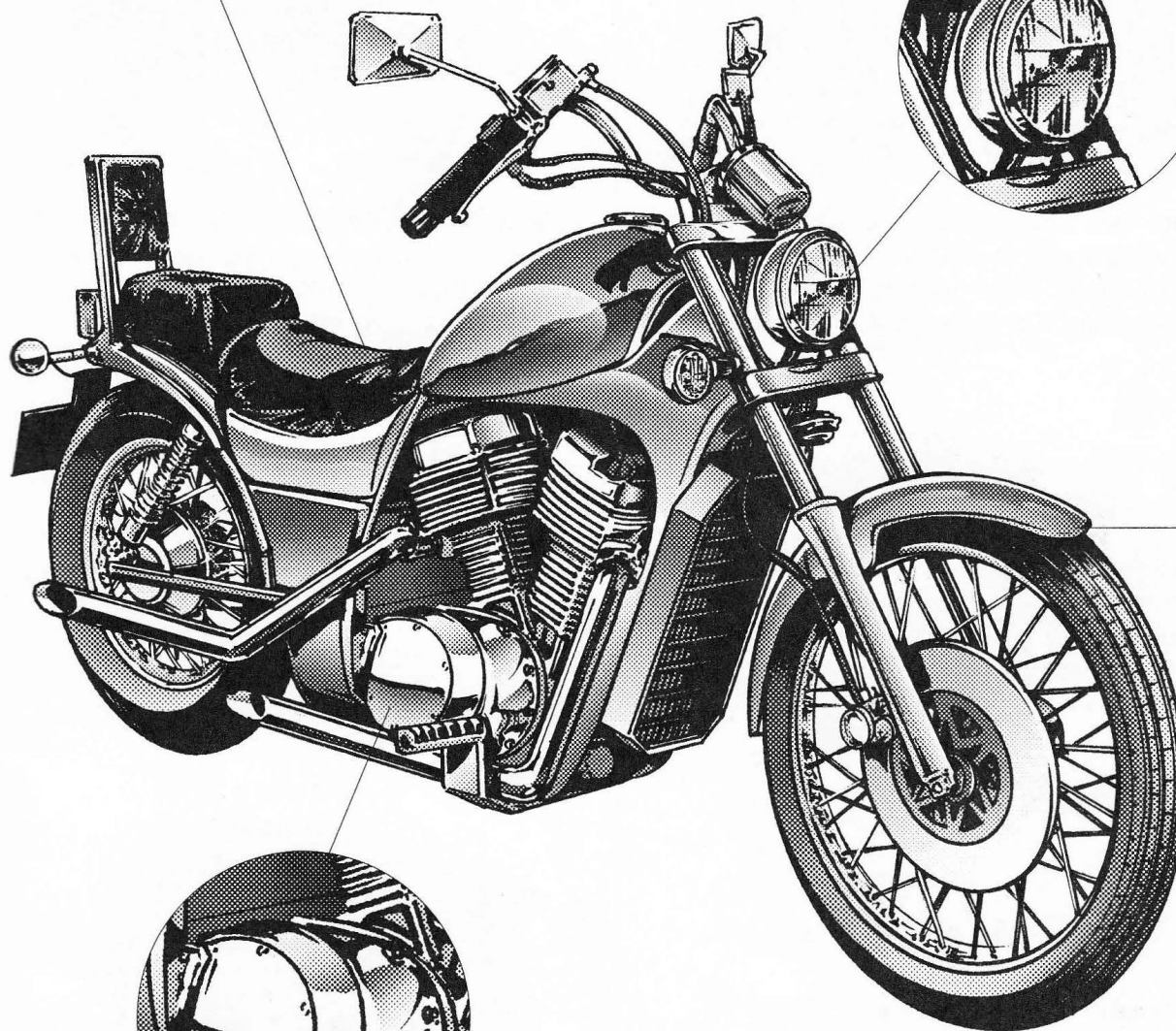
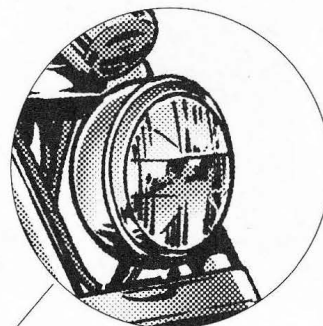


### Leather (Seat)

Leather has a similar feel to rubber: avoid adding white highlights and instead obtain a matte finish using large-dot, dark screen tones.

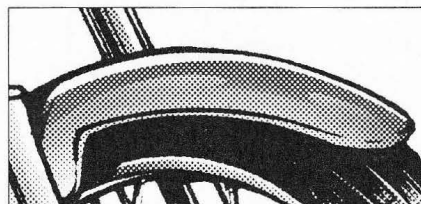
### Glass (Headlight)

Create the look of transparent glass by drawing and distorting the region on the other side of the glass and adding minor screen tone touches.



### Metal/Chrome (Engine)

Produce the intense light and dark contrasts found in chrome plating by drawing ground line reflections and then adding a dark gradation tone lightening in a downward direction.



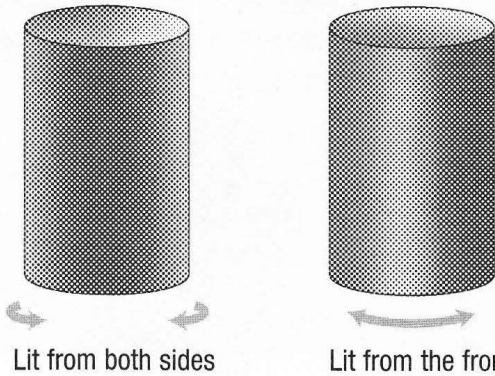
### Plastic (Turn Signal Indicator)

Add highlights to the upper section, dark screen tone to the mid-section, and light tone to the lower section to produce the luster of plastic.

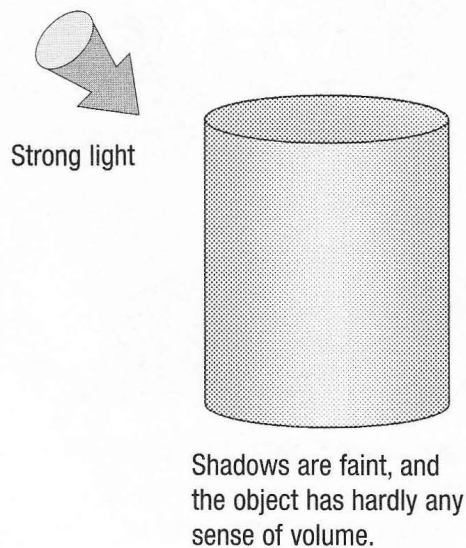
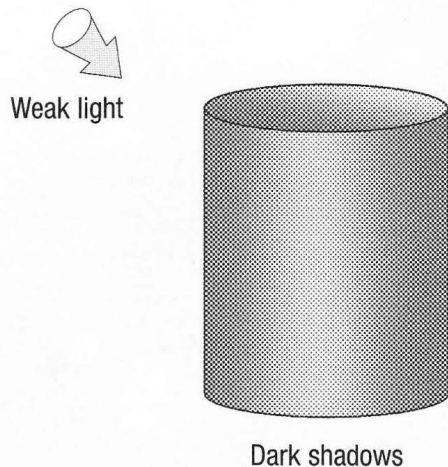


## Using Depictions of Light and Shadow to Generate a Realistic Sense of Texture

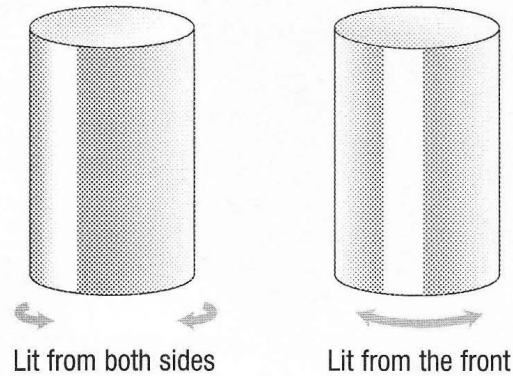
### Substances without a Sheen (Rubber, Aluminum, etc.)



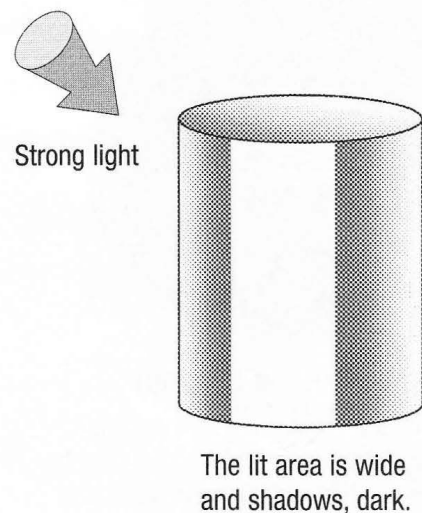
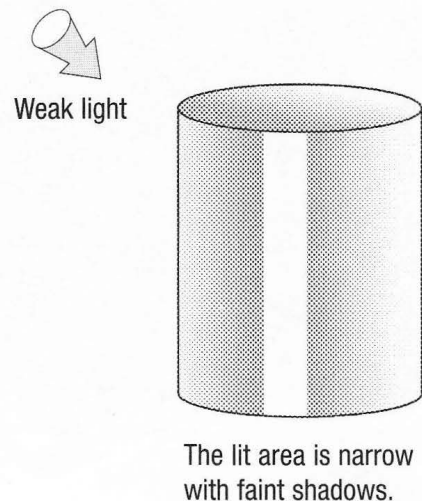
Since these substances do not readily reflect light, highlights should be weak. Use large-dot, dark screen tone for rubber and detailed, light gradations for aluminum. (The above cylinders are rubber.)



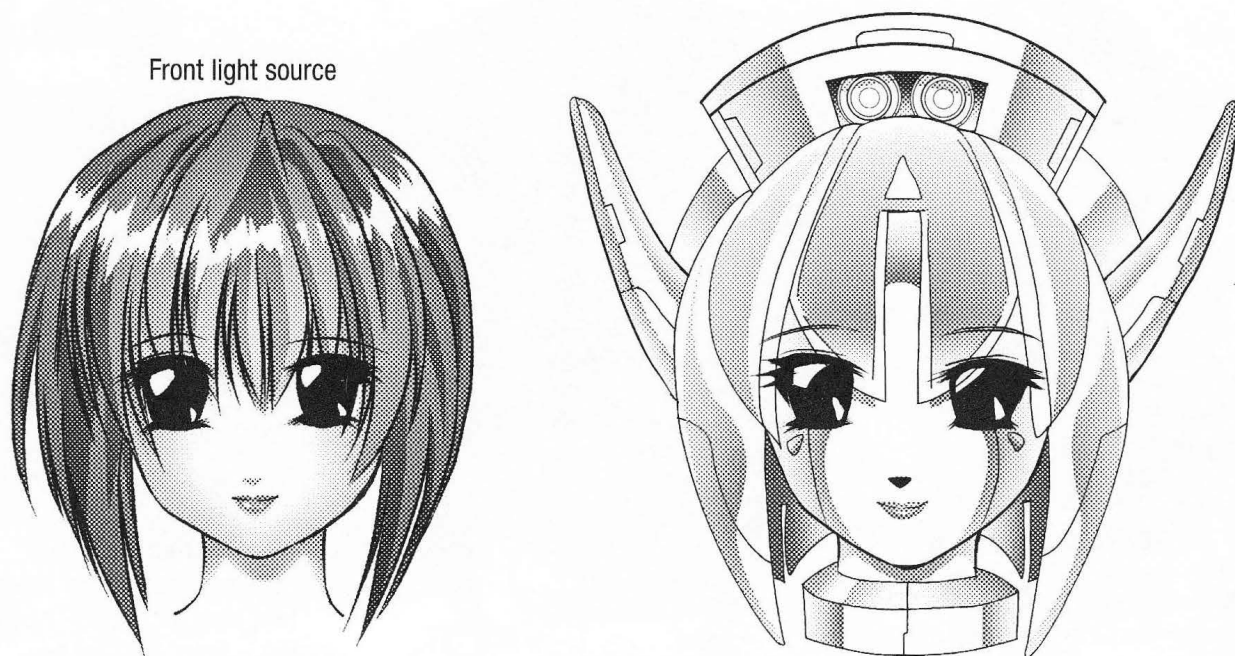
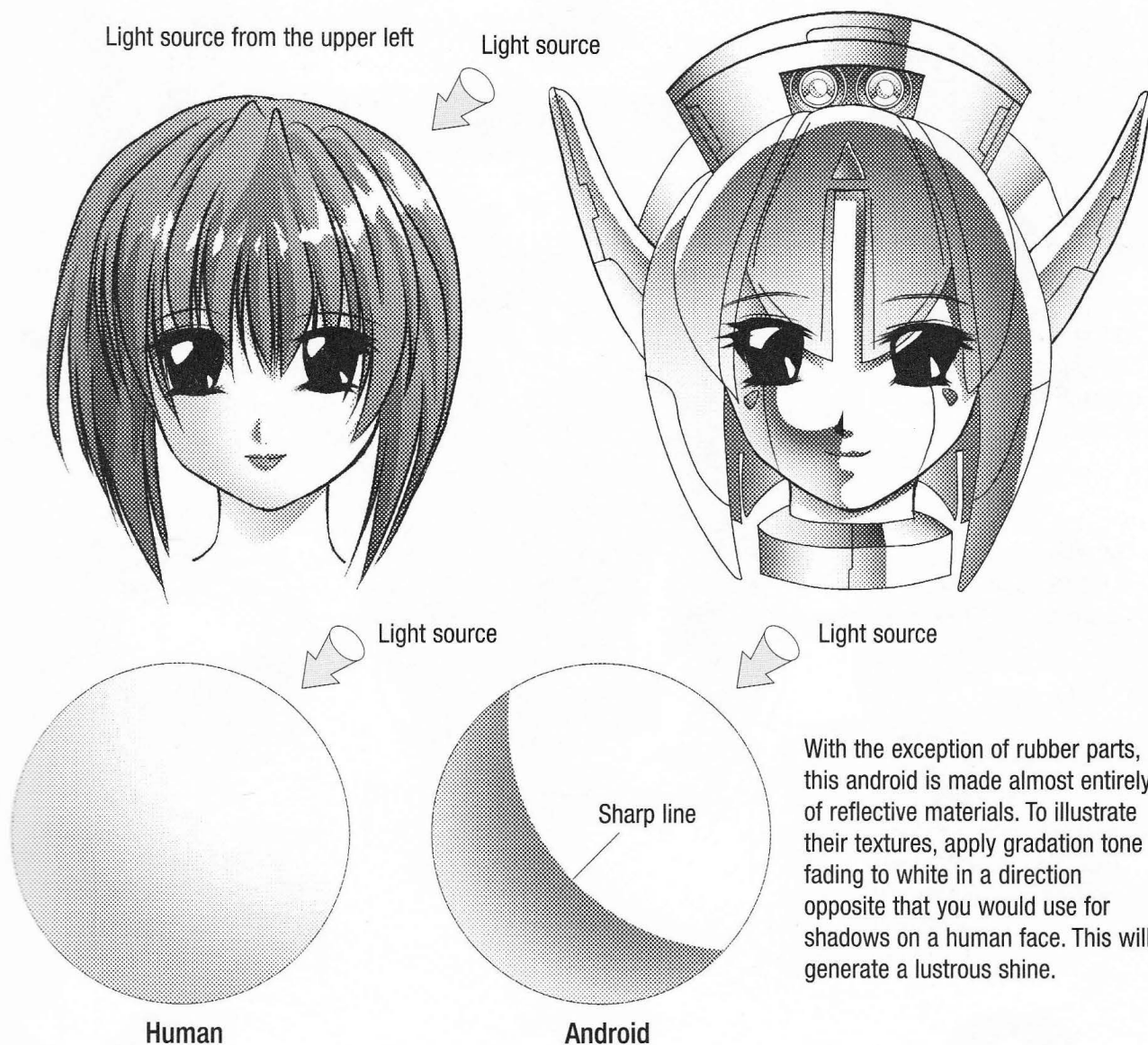
### Substances with a Sheen (Plastic, Glass, Metal Plating, etc.)



Since these substances do reflect light, extensive use of highlights is appropriate. Add shadows by attaching gradation tone starting from sharply delineated areas of light.



## ● Humans vs. Androids



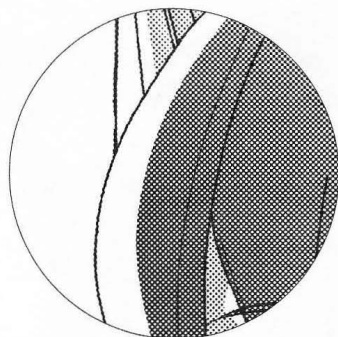
## ● Rendering the Same Android Face in Four Different Textures



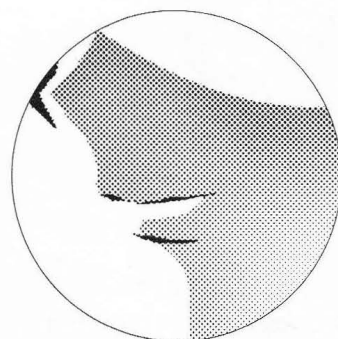
Light source

# 1

### Metal (Chrome)



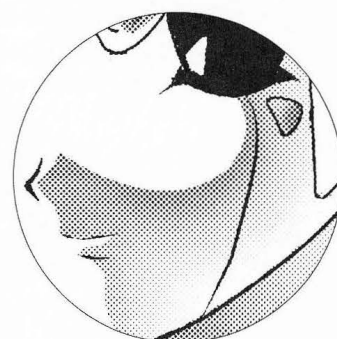
Adding sharply delineated highlights to the outer contours generates a sense of luster.



Adding highlights to the lower lip produces a sense of plumpness.



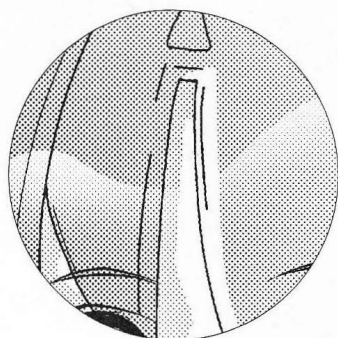
Reference android face



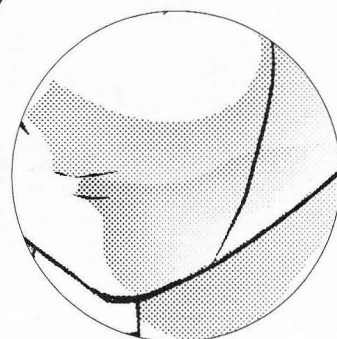
Applying a dark gradation tone with a clearly defined edge generates a metallic look.

# 2

### Plastic



The addition of bright reflections to the hair produces a lustrous sheen.

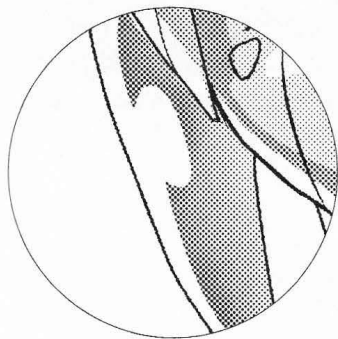


Adding somewhat dark reflections to the light screen tone used for the skin again has a lustrous effect.

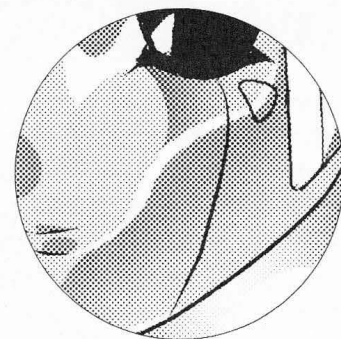


# 3

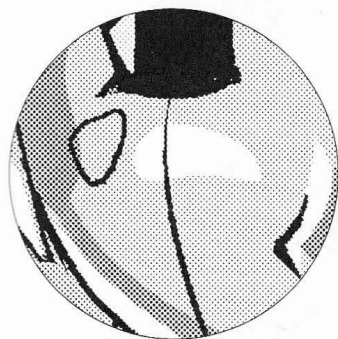
## Glass



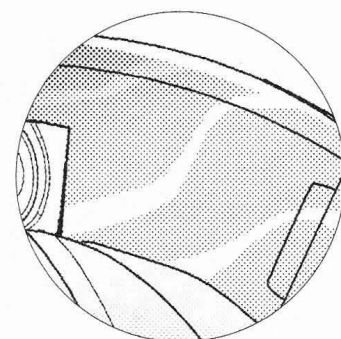
Distorting contour lines creates the impression that the scene from the other side of the glass object is visible.



Add light gradation screen tone starting from the distorted contour lines to create reflections, generating a sense of luster.



The addition of ovoid highlights produces a sense of sheen.



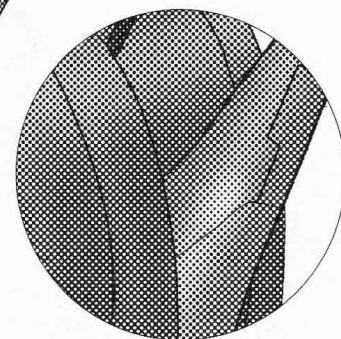
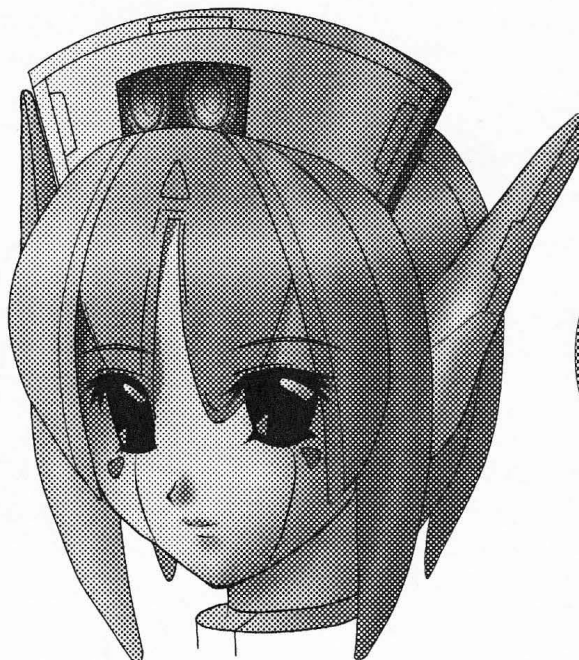
Even the addition of wavy highlights generates the look of glass.

# 4

## Rubber



Rubber should have no sheen: use large-dot screen tones from the 40's and 50's series.



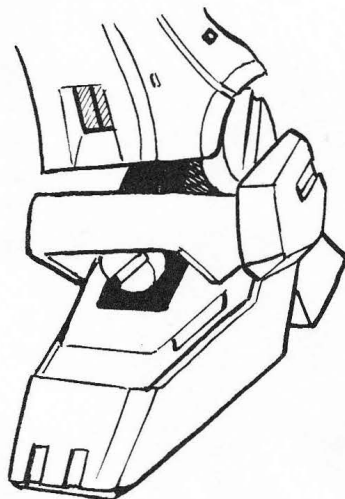
Rubber absorbs light, so avoid adding highlights and instead apply dark gradation tones overall.

## Tricks in Rendering Textures Using Pen and Screen Tone

There are many different types of pen nibs available, which are used according to the artist's purpose or type of drawing to be done. The most well-known nibs are 1) the G-pen, excellent for thick lines, 2) the maru-pen (also known as crow quill pen), suited for fine lines, and 3) the saji-pen (also known as spoon pen), suited to creating special effects.

In addition, screen tones are often used to create shadows or shading not possible solely with a pen. Combinations of screen tone and pen will allow you to produce artwork not possible in just pen or screen tone alone, expanding your artistic repertoire.

**G-pen**

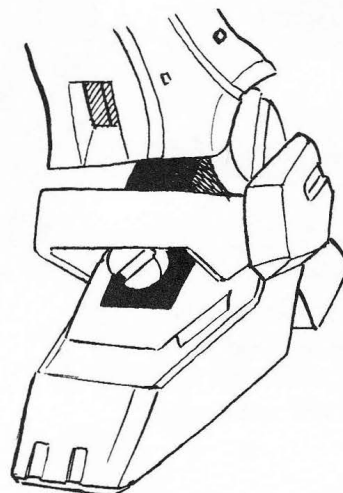


This nib is suited to thick, bold strokes. Use it for silhouette lines and the like.

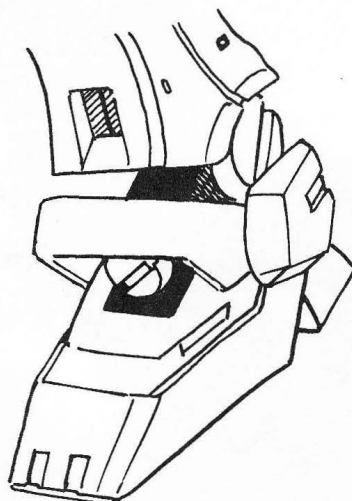
**Maru-pen  
(Crow quill pen)**



As this nib is suited to fine lines, use it when detailed hatching, etc. is needed.



**Saji-pen  
(Spoon pen)**

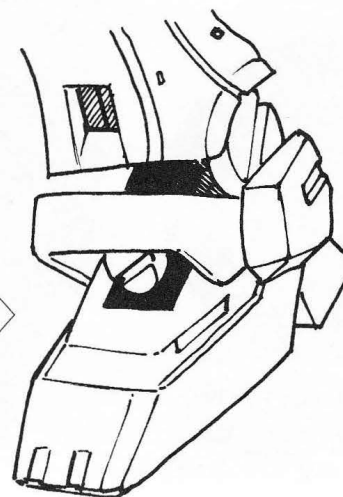


The Saji-pen nib has a firm point, appropriate for drawing even strokes. Use it with special effects, etc.

**Line pen**

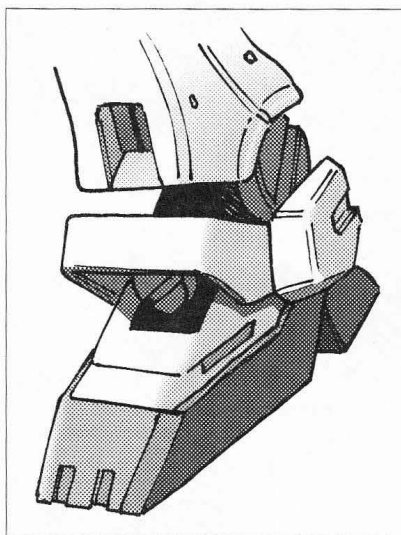


Line pens (also known as technical pens or milli-pens) come with a variety of nib widths and are consequently terrific for drawing even lines.



## Using Combined Techniques to Depict Grime and Rust

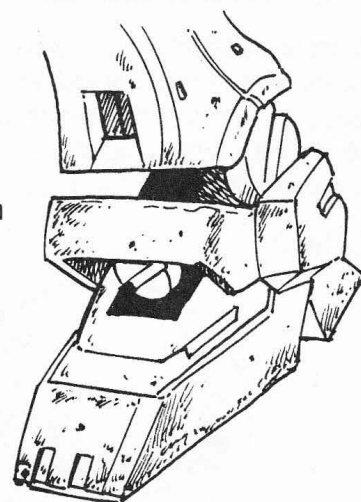
Simply affixing screen tone to a plain pen drawing will create the impression of a pristine object (see fig. below). Try attaching tone to a drawing with intentional soiling and then etching the tone with a craft knife to suggest dirt and grime.



Typical Sample of Screen Tone Usage

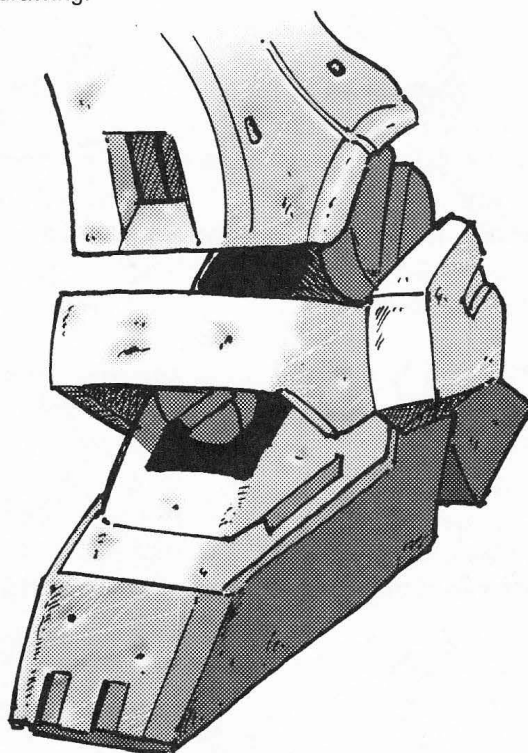
### • Sole Use of Hatching

Use a maru-pen or line pen for close and detailed hatching in order to produce a soiled look. Take care in that overdoing it could result in a messy-looking drawing.



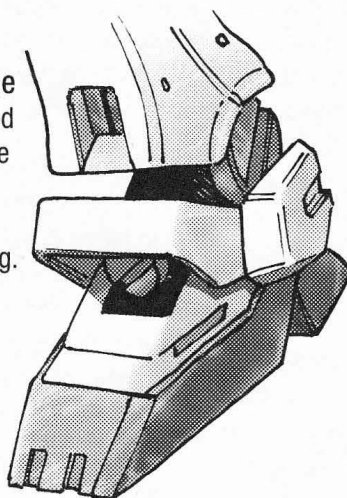
### Combination of Hatching and Screen Tone

The "grime" or "rust" effect is magnified upon etching a screen tone over a hatched drawing.



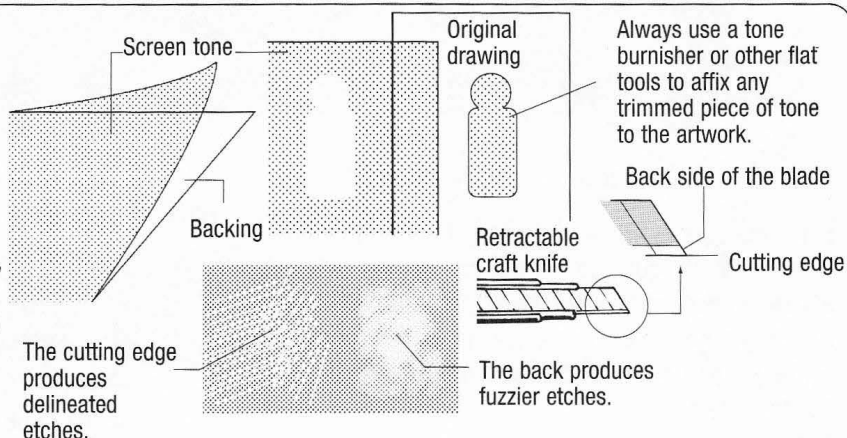
### • Sole Use of Screen Tone

Here, the tone is lightly etched using the back of a craft knife producing a reasonably convincing grime effect; yet, something still seems missing.



## What is a screen tone?

A screen tone is a transparent sheet with an adhesive backing and tiny dots printed on the front. Screen tones are useful for achieving a sense of volume by trimming and attaching the tone. Etching the tone's dots with the cutting edge or back of a craft knife blade can also create various special effects. A copious variety of designs are available: dot, gradation, random dot, hatching, patterned, etc., so it would be well worth the effort to collect tones according to your needs. Screen tones can be found at stationery and art-supplies stores. \*In North America, we recommend [www.comictones.com](http://www.comictones.com) for all the manga supplies you need.

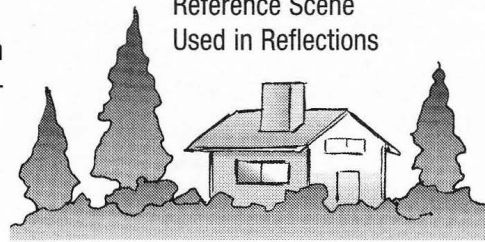




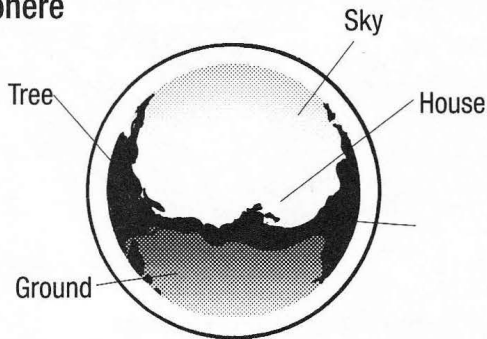
# The Trick to Metallic Textures Lies in the Reflections

Chrome-plated metals, etc. contain reflections of surrounding buildings and the rest of their environment. Let's play around with using reflections on a sphere or cylinder and try to create a three-dimensional, metallic object. We'll also use a car as a practical application example.

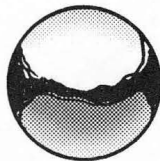
Reference Scene  
Used in Reflections



## Sphere

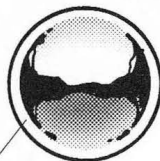


Not good



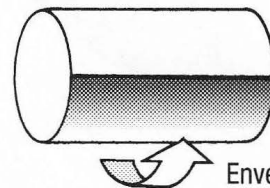
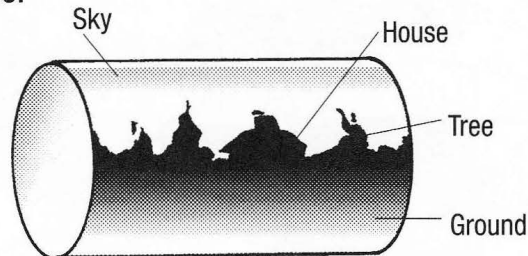
Drawing the reflections directly touching the silhouette line robs the object of any sense of volume.

Good



Encasing the reflections drawn toward the sphere's perimeter in highlight produces a sense of volume indicative of a sphere.

## Cylinder



Enveloping light

Draw a reflection of the ground line down the cylinder's center. Attaching gradation tone that lightens in a downward direction generates the appearance of enveloping light, creating a sense of volume.

## Practical Application

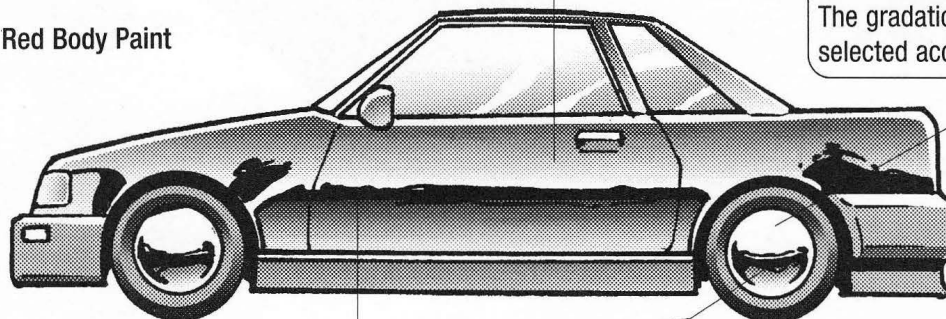
Not all metals are plated chrome. Cars with colored paint jobs may also be easily rendered using the same means for producing a chrome-plating effect.

Attaching gradation screen tone of a density matching (i.e. suggestive of) the target color for the space (sky) above the ground line produces the illusion of that paint color. Since this car is supposed to be red, use a screen tone gradating from 0% to 70% in density.

## Tip

To find a density of gradation tone suited to the car's target color, conceive of the color in terms of value rather than hue, since screen tone only comes in varying densities of black and white. For example, in a black and white image, black would have a density of 100%. Red would then be 70%; blue, 60%; green, 40%; and yellow, 10%. The gradation screen tone should be selected according to these parameters.

## Red Body Paint

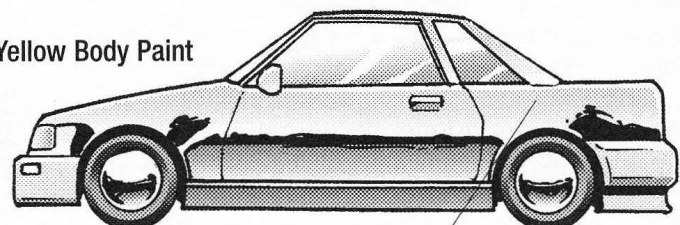


Scene above the ground line

Since the door is arced, you can apply the same reflection techniques as used in the cylinder example above. Drawing the ground line down the door's center and then attaching a dark gradation tone lightening in a downward direction produces the desired effect.

Since this is a dark paint color, the trick is to give consideration to balancing light and darks by adding pure white highlights to heighten the "chrome-like" texture.

## Yellow Body Paint



Adding tone gradating from 0% to 10% suggests a yellow paint job.

## Metal Girl

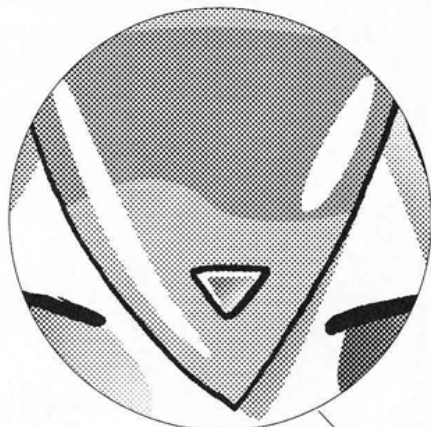


Balancing out the contrasting lights and darks and adding gradation tone finishes off the figure, replete with a sense of chrome.

## Liberal Combining the Four Textures While Keeping Color in Mind

### ● Android Face

Hair: green plastic



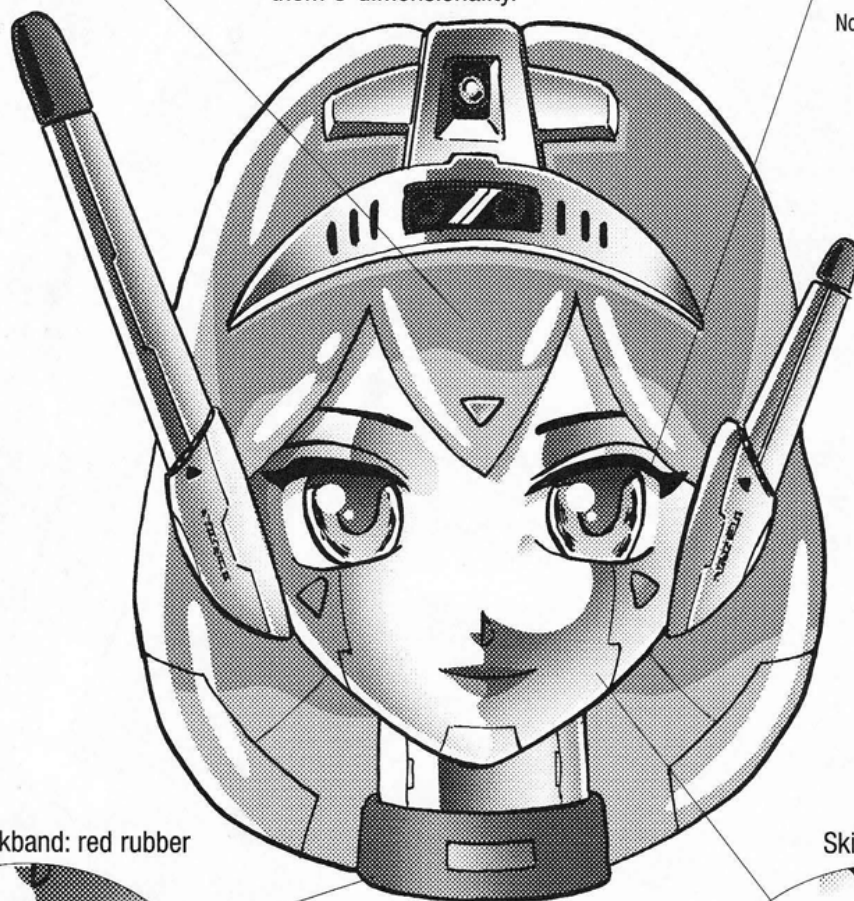
Suggest reflections by using two screen tones of different densities, distinguishing the different parts. Add long, pure white highlights following the hair's silhouette line to suggest shiny plastic.

Iris: smoke-tinted glass

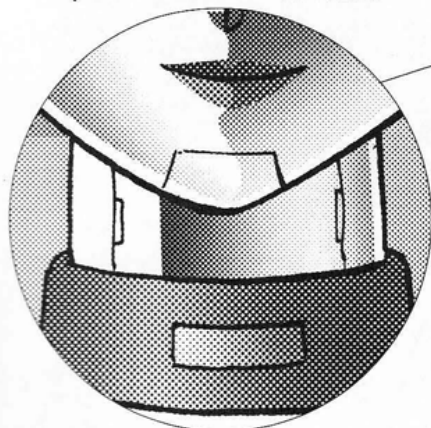


Use a dark gradation for the pupil and a lighter gradation for the iris. This will give the eyes a transparent feel. Circular highlights will simultaneously make the eyes appear to shine as well as give them 3-dimensionality.

Note: Smoke refers bluish grey.



Lips and neckband: red rubber



Adding a large-dot, dark gradation will suggest the matte finish of rubber.

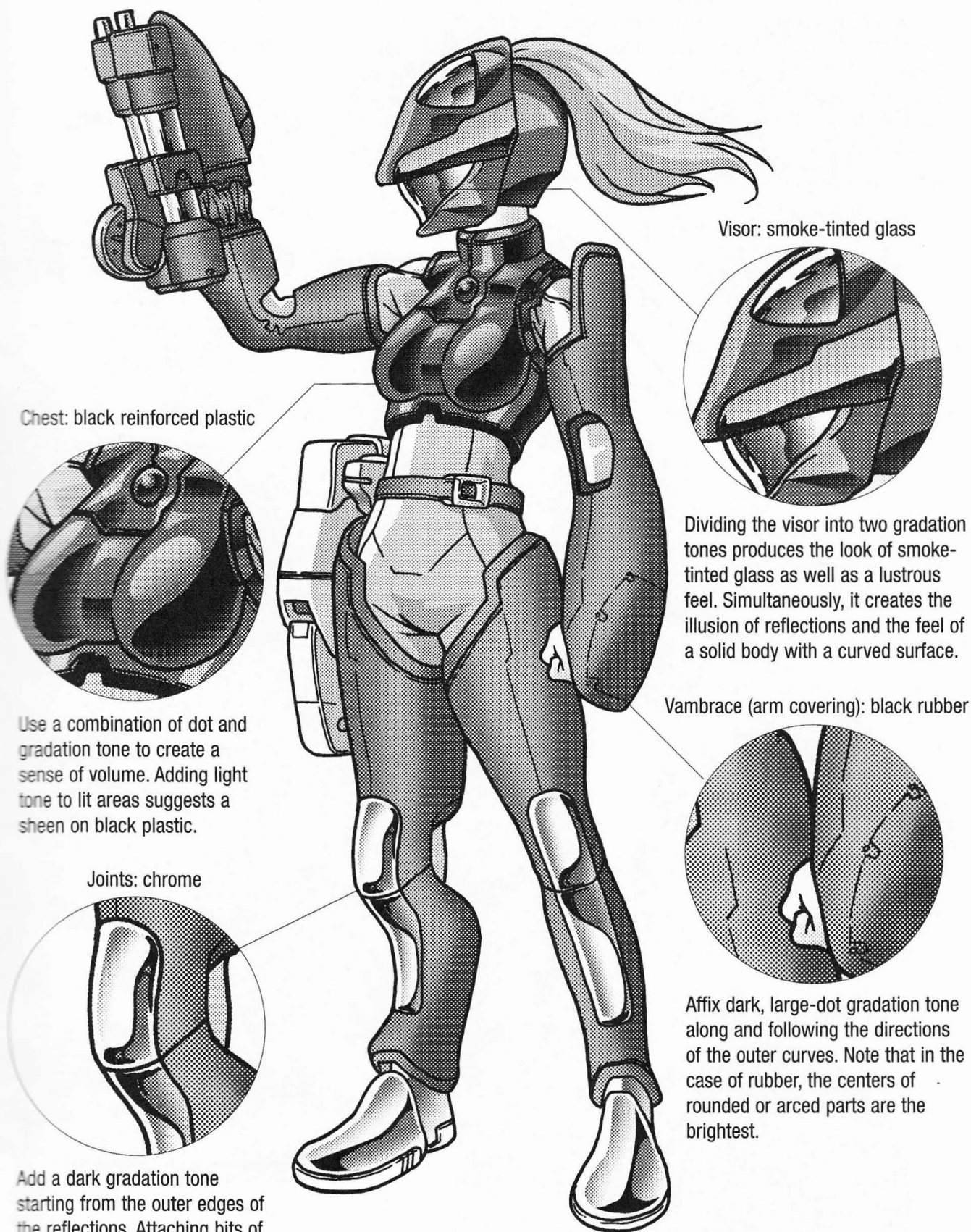
Skin: chrome



The shadows are clearly delineated and rendered using a dark gradation tone. The addition of highlights provides for strong light/dark contrasts.



## ● Full Body

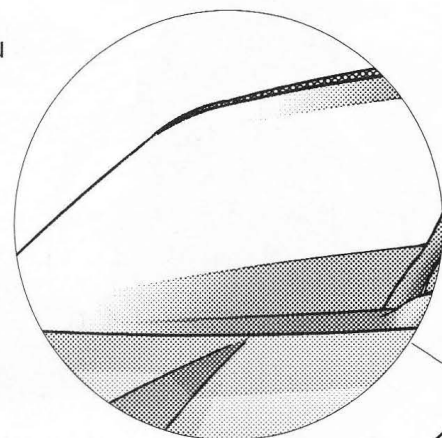


By giving consideration to color, you will be able to suggest the four textures (metal, plastic, glass, and rubber) in greater complexity.

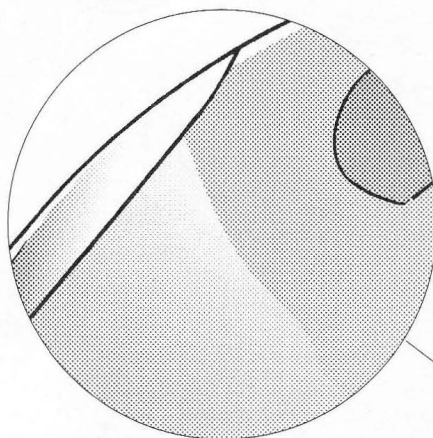
## A Car Is a Treasure Chest in Portrayal of the Four Textures

A once over of any car will tell you that it is made of all of the four textures: the body is metal, the lights and front windshield are glass, the bumpers are plastic, and the tires are rubber. On top of that, the same techniques for rendering plastic and rubber can be used for aluminum wheels or cloth seats. Once you are capable of competently depicting the four textures, you will be able to create any type of machine, including a car.

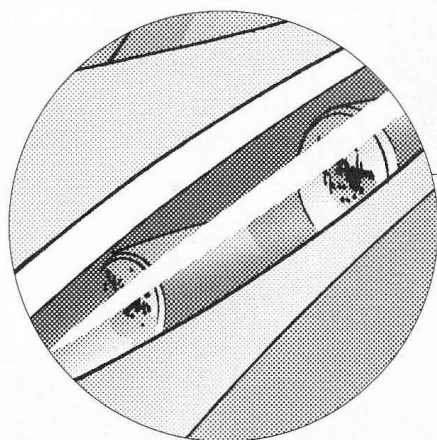
Front windshield (glass)



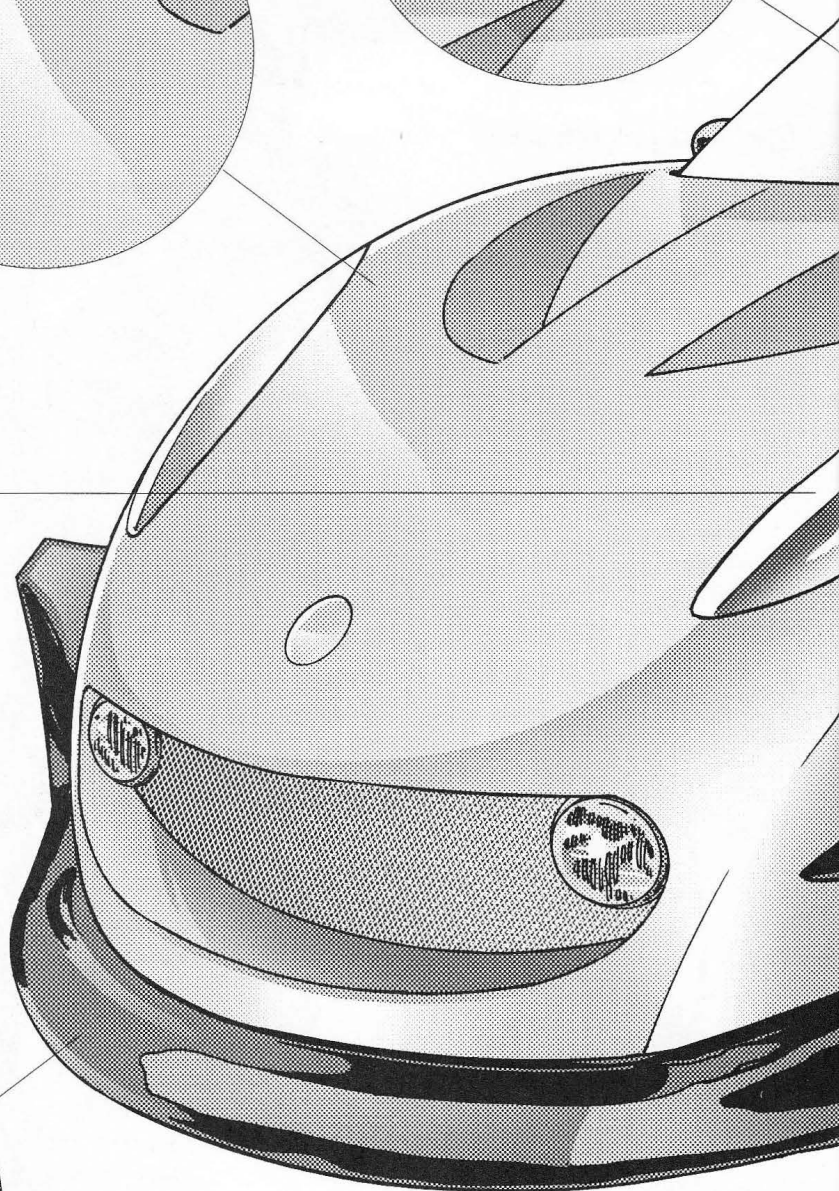
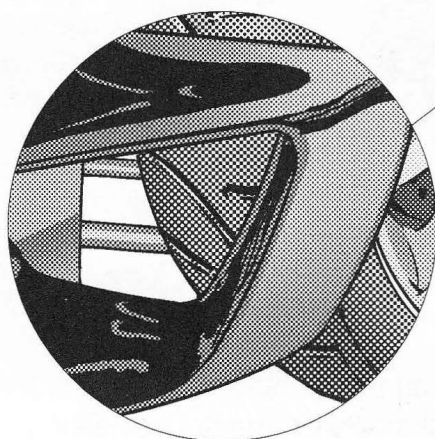
Body (silver-colored metal)



Headlights (clear glass)

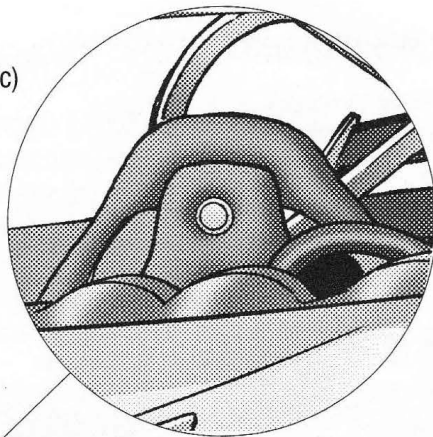


Bumper (black plastic)

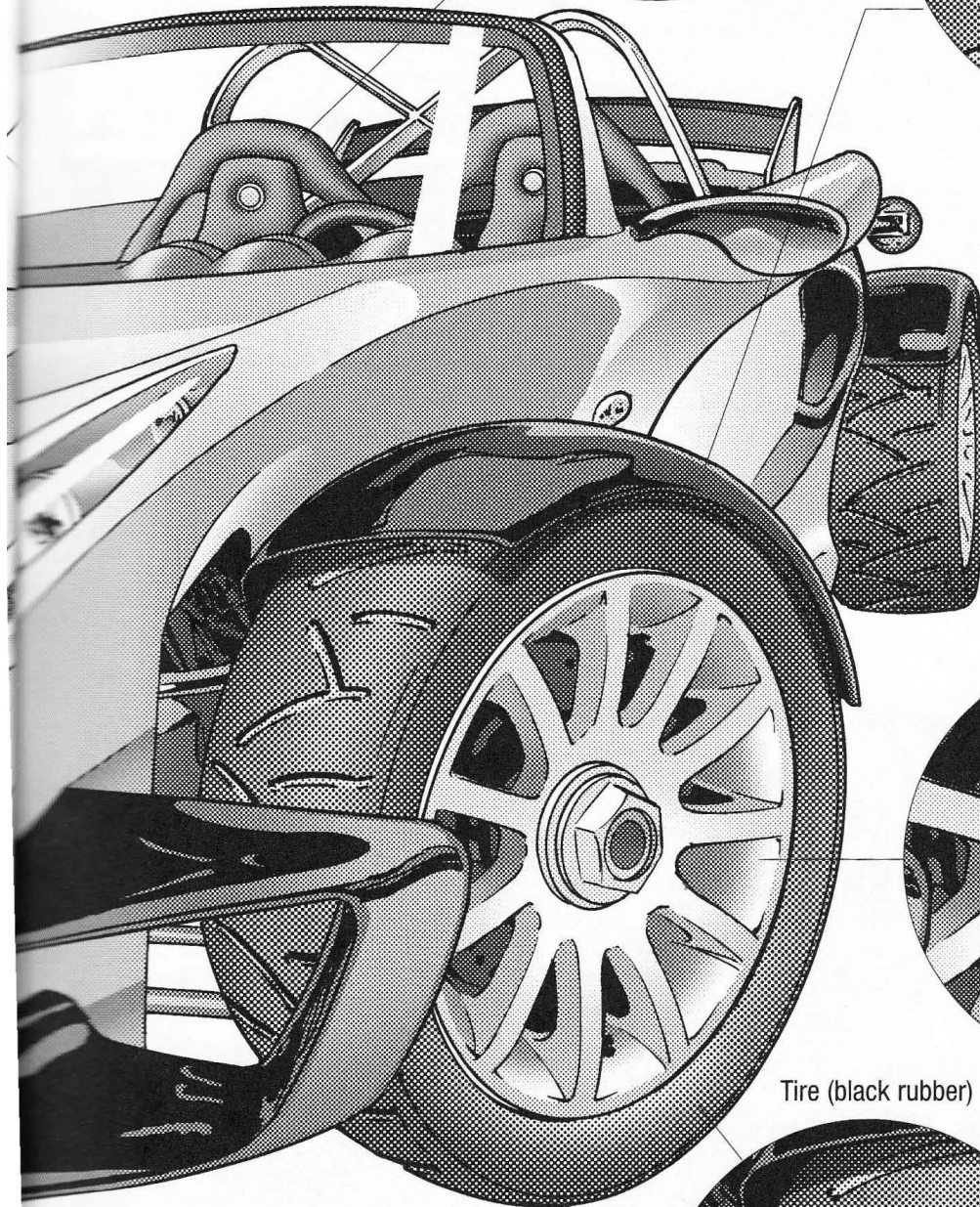
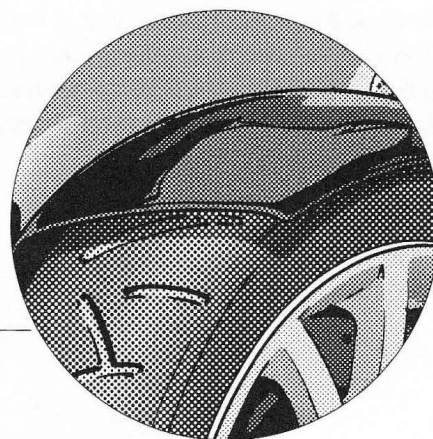




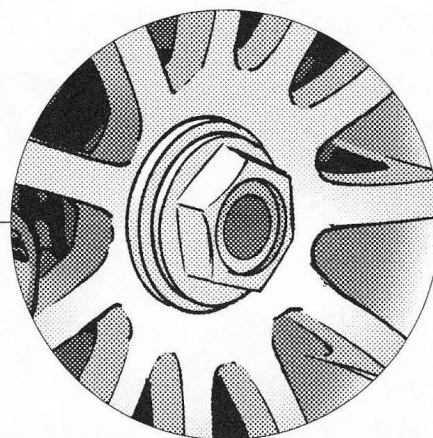
Seat upholstery (red fabric)



Fender (black plastic)



Wheel (silver-colored aluminum)



Tire (black rubber)

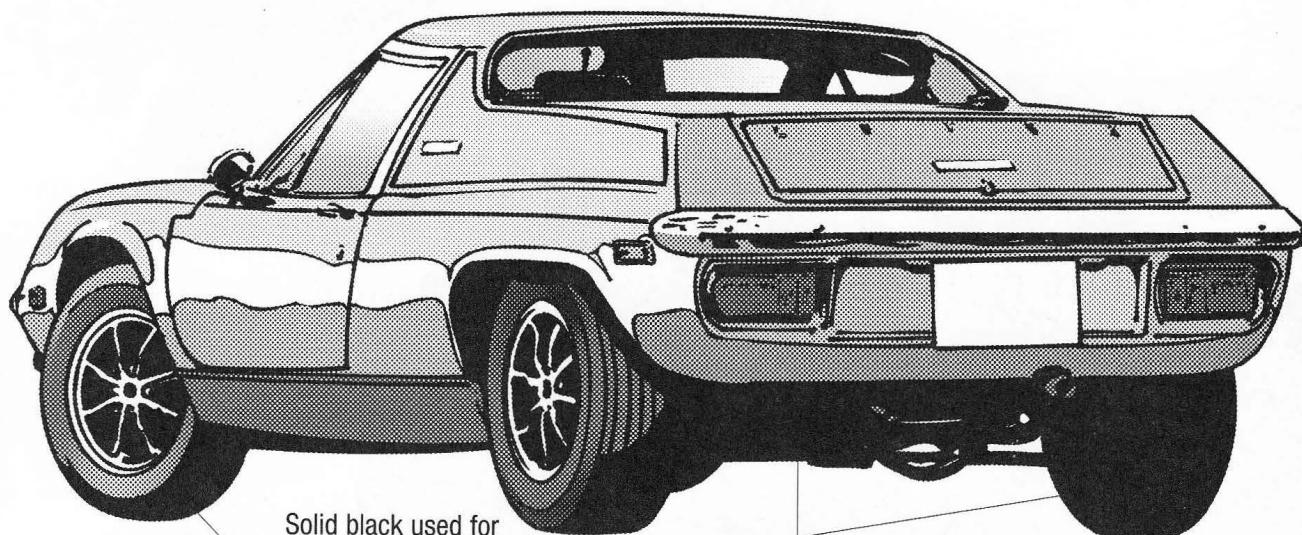




## Making Use of Blacks to Gain Weightiness

Dark machines seem naturally to contain a sense of weight. However, it is quite a difficult task to make a white, yellow, or other light colored car look sufficiently heavy. Adding solid blacks to the car's underside lowers the car's visual center of gravity, producing a well-balanced sense of weightiness.

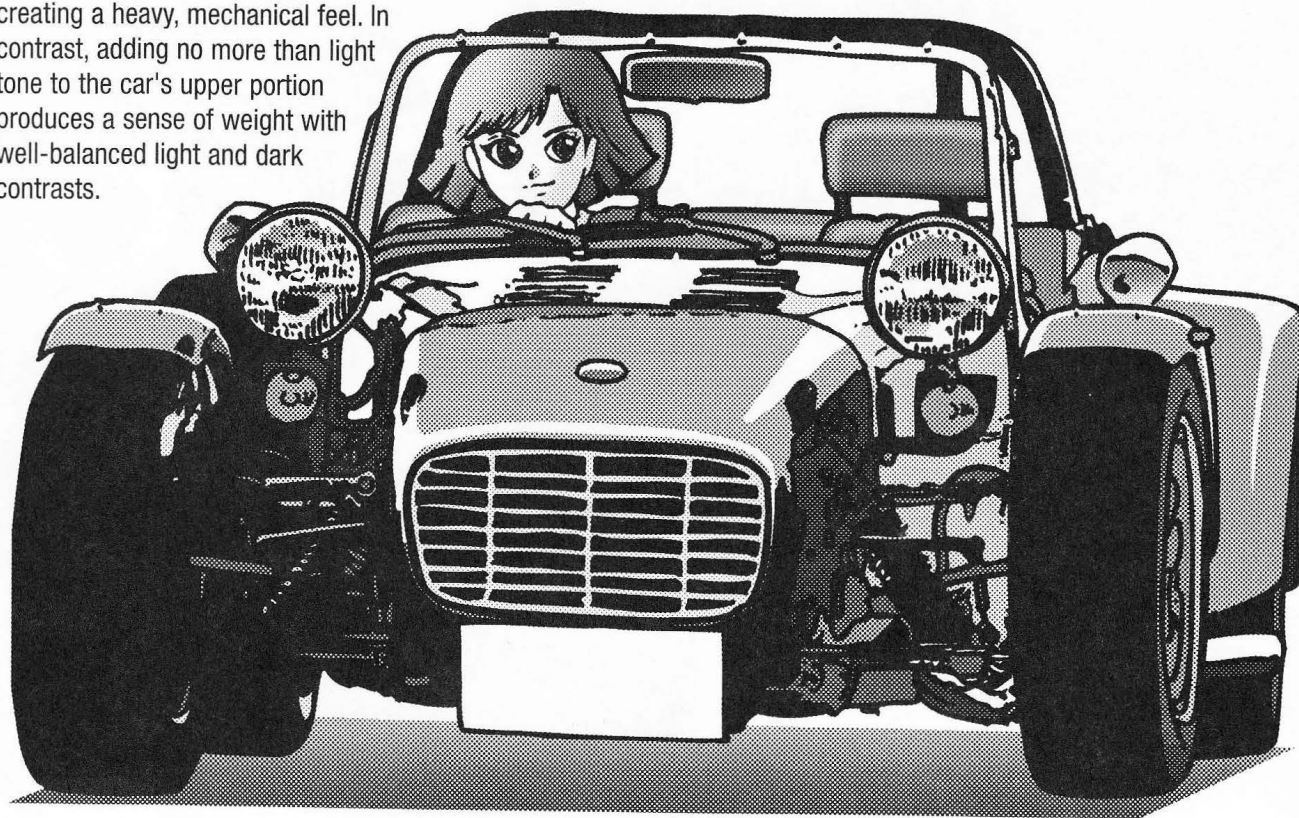
Adding profuse amounts of solid black to the tires and car's underside, and then finishing the car off with light screen tones will also generate a sense of weight. Furthermore, adding solid blacks to the car's interior (visible through the windows) will provide a contrast as well as create a sense of depth.



Solid black used for the tire's underside

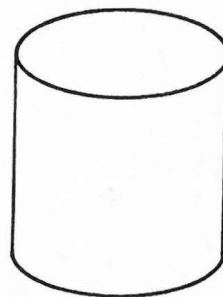
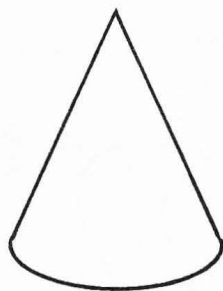
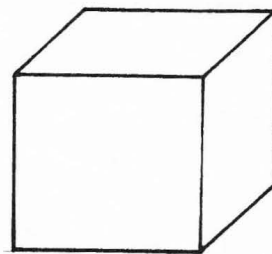
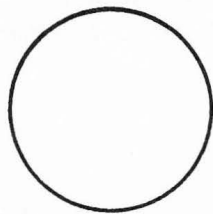
Solid black used for the car's underside

Here, the entire underside, including the tires, are rendered in solid black, while highlights have been added to the mechanical parts of the wheels, creating a heavy, mechanical feel. In contrast, adding no more than light tone to the car's upper portion produces a sense of weight with well-balanced light and dark contrasts.



# Chapter 2

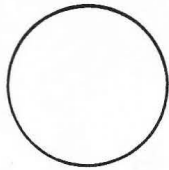
## Learning Simple Mecha Structures from the Basic Shapes



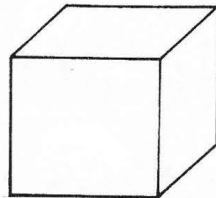
# Learning the Basic Structures of Machines

Machines are aggregates of spheres, cubes, and other three-dimensional geometric shapes. Machines that appear complex may also be considered transformations of such shapes.

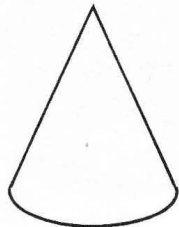
## Basic Shapes



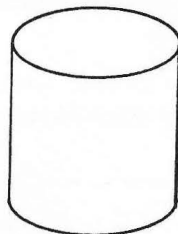
Sphere



Cube



Cone



Cylinder

## The Five Steps in Drawing Mecha

### 1 Put Together Various Geometric Shapes

Compose the machine's basic form using squares, cylinders, and other shapes.

### 2 Trim the Shapes

Chop off those portions that are unnecessary. Adjust the shapes.

### 3 Transform

Eliminate points and round off corners. Fine-tune the shapes.

### 4 Add Parts

Add any necessary supplementary parts.

### 5 Draw in the Details

Add any details.

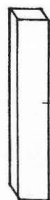
- If you keep in mind these five stages, you should be able to draw any machine.

## 1

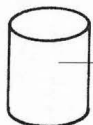
### Put Together Various Geometric Shapes

#### A Lamp-

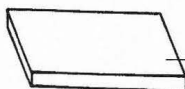
Base and Neck Components



Neck

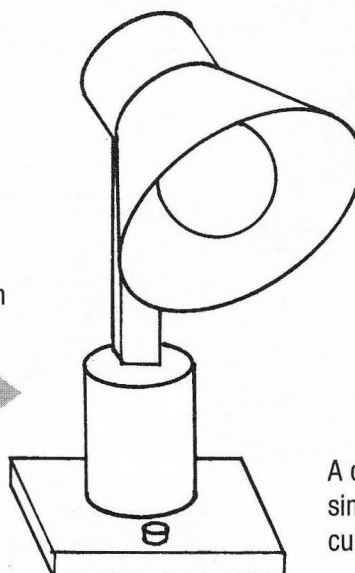


Body

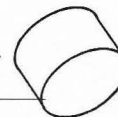


Base

On/off button

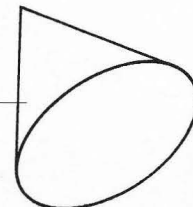


Light bulb socket cover

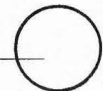


Lamp Components

Lampshade



Light bulb



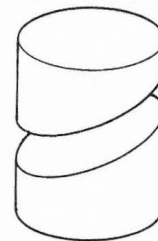
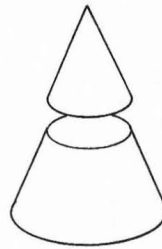
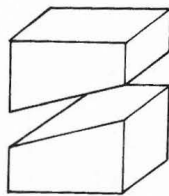
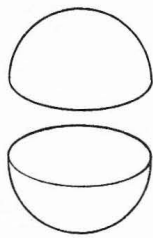
A desk lamp can be constructed simply by combining a sphere, a cube, and other geometric shapes.



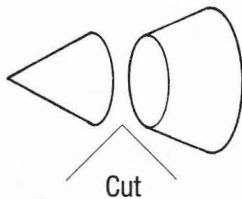
# 2

## Trim the Shapes

Cutting up the basic shapes allows you to represent more complicated machines.

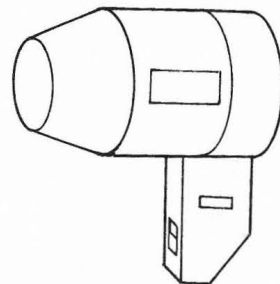
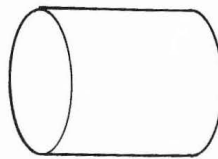


### A Hairdryer

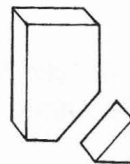


A cone is divided into pieces.

+



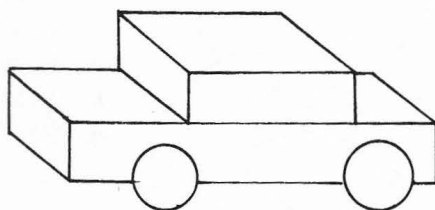
### Completed hairdryer



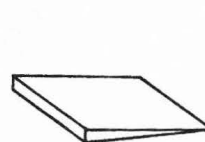
Cut

A rectangular solid is divided into pieces.

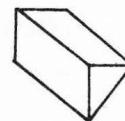
### A Car



Making a few diagonal slices results in a more realistic-looking car.



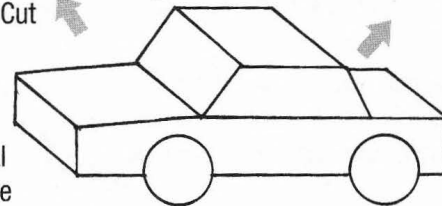
Cut



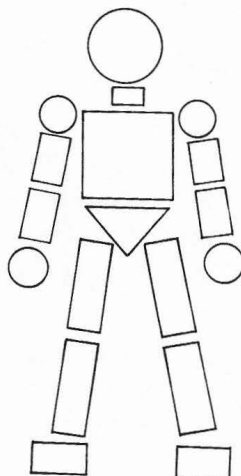
Cut



Cut



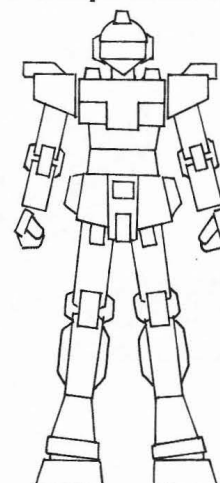
### Take simple shapes



Chop here and divide there

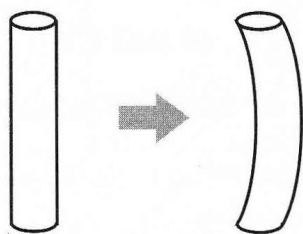
Even a simple building block man can be transformed into a complex automaton simply by slicing and carving each geometric shape.

### Create complicated machines

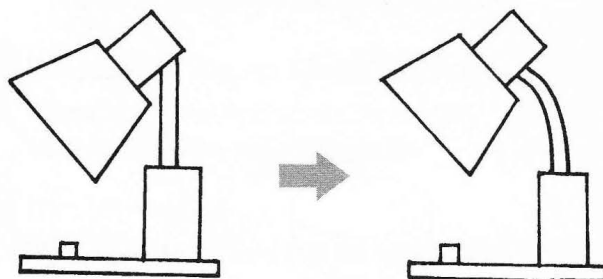


### 3 Transform

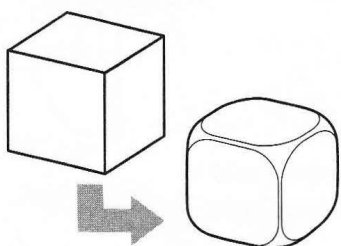
After having carved and sliced the geometric shapes, add minor changes, such as bending straight parts or rounding points to arrive at a more pleasing form.



Bend straight parts



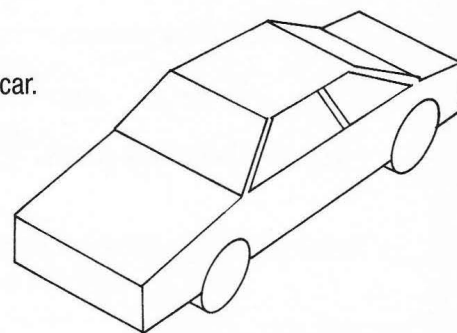
Simply modifying the lamp's neck produces a stable, appealing form.



Points and edges are rounded.

Here, we have a cold, inanimate car.

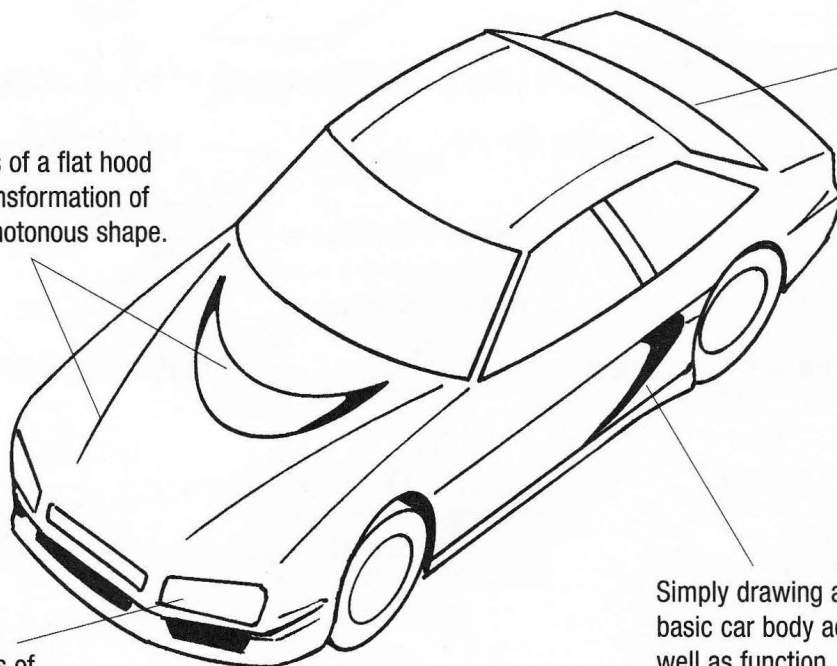
**However, by modifying the shape...**



A cold, highly angular car

Elevating portions of a flat hood allows for the transformation of an otherwise monotonous shape.

Rounding the corners of previously pointy headlights offers a softer appearance.



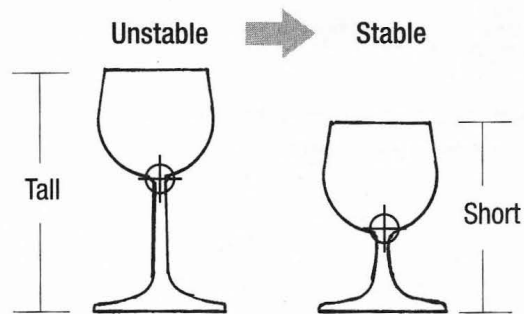
Rounding corners and edges overall makes for a gentler image.

Simply drawing air intakes on a basic car body adds to form as well as function.

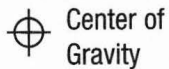
**A new, beautiful form is born.**

## Stability

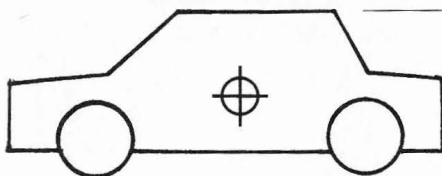
Robots with huge heads and inordinately tall cars appear unstable and look as if they are about to topple. This element of instability gives rise to poor visual balance. To balance an object visually, you must lower its center of gravity. In other words, lower its height and/or widen it to give it a balanced, stable form.



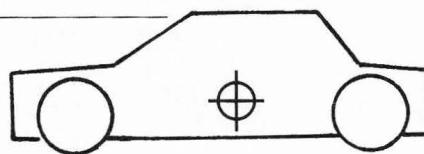
Simply lowering the height of a tall wineglass causes its center of gravity to drop, resulting in a stable wineglass.



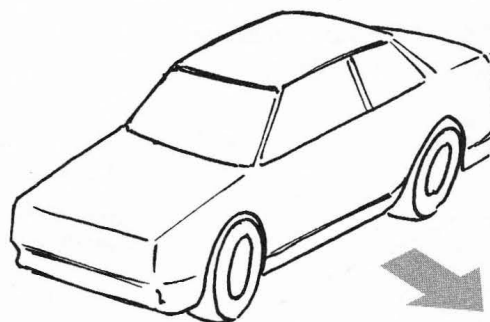
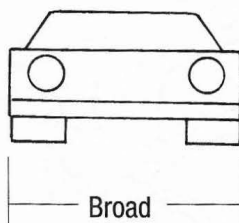
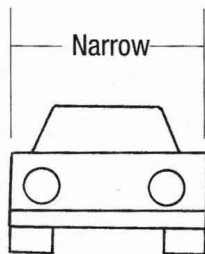
Lowering the roof of a car



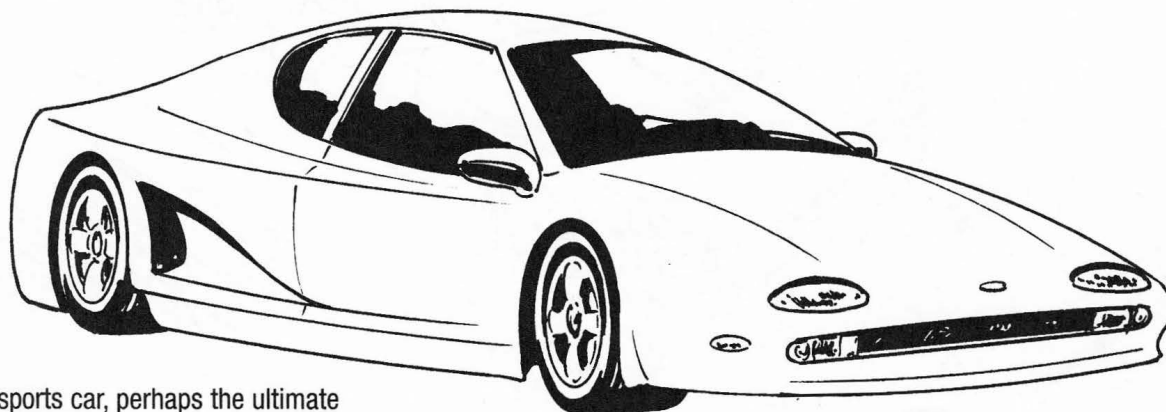
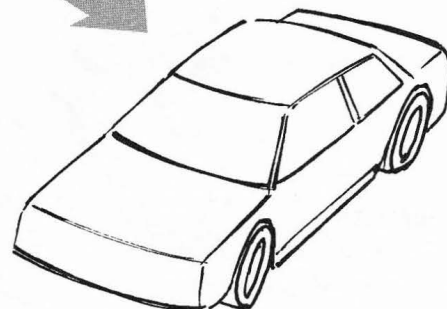
Here, the car's center of gravity is too high, so it has no sense of stability



Here, the center of gravity is lower, and the car appears stable.



Widening an object also makes it appear more stable, resulting in a more pleasing form.



A sports car, perhaps the ultimate automobile, is low and wide, resulting in a beautiful, stable design.



# 4

## Add Parts

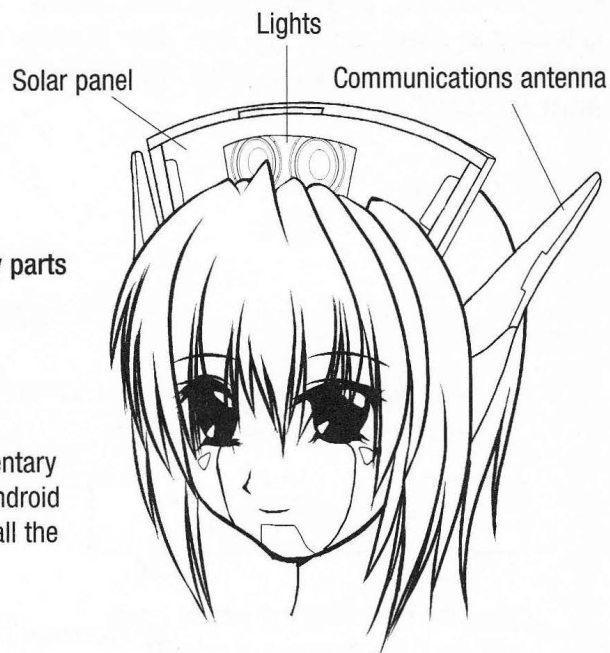
Add parts that assist movement or enhance the machine.



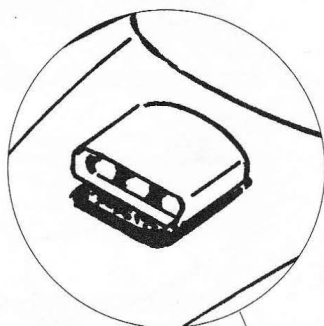
Add supplementary parts



Attaching supplementary parts to a female android makes her appear all the more real.



Cars come with an array of optional parts intended for various purposes, so playing around with different combinations is also fun.

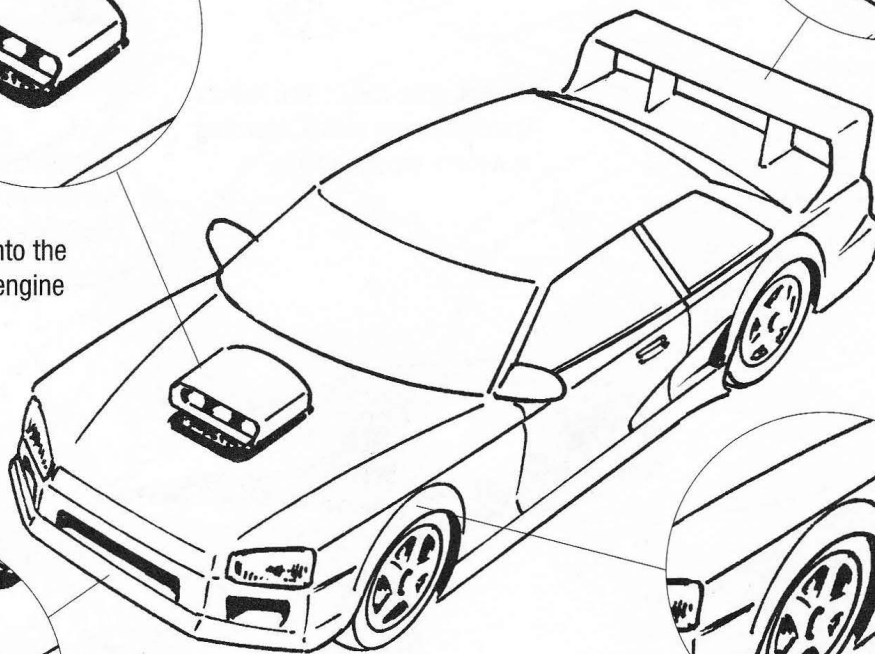
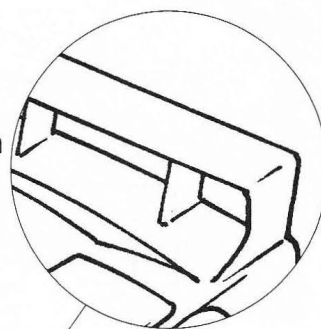


### Supercharger

This device forces air into the car's engine, boosting engine power.

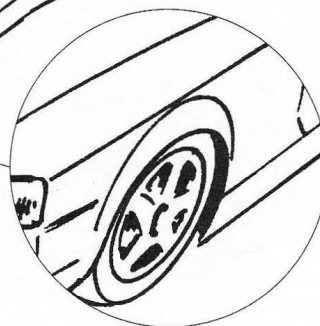
### Rear wing

The rear wing uses the down force of airflow to keep the car on the road, providing stability at high speeds.



### Front spoiler

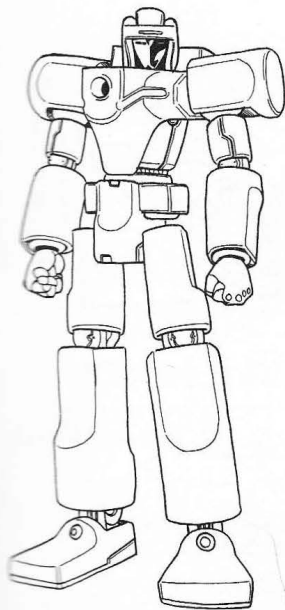
This functions by adjusting airflow to reduce resistance.



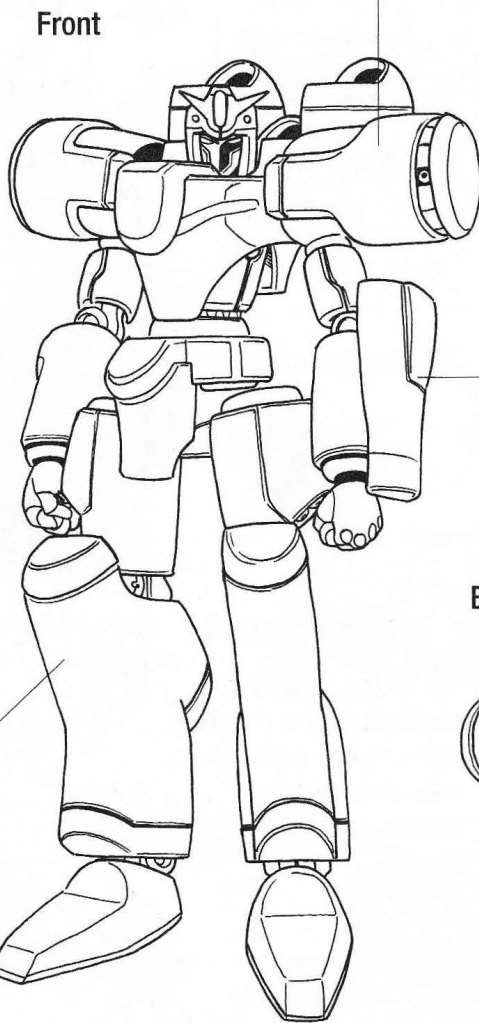
### Fender flare

This reduces air resistance on the tire.

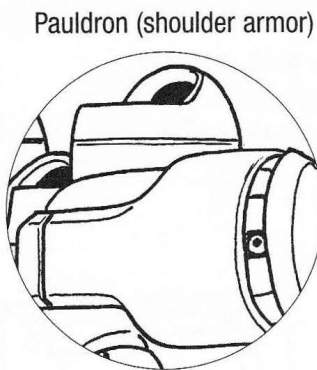
Robots come with a wide array of optional components: armor (Note 1) designed to reinforce the body, backpack thrusters (Note 2) and other rockets that allow it to fly, protective shields, and a host of others, allowing the artist to arrive at an interesting combination.



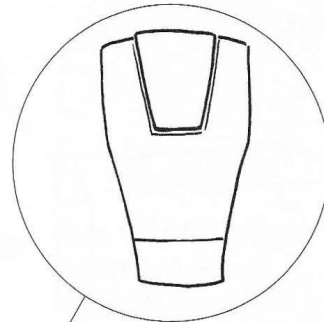
Basic form



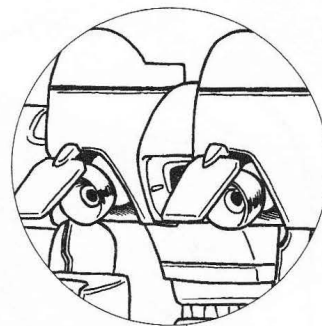
Front



Pauldron (shoulder armor)



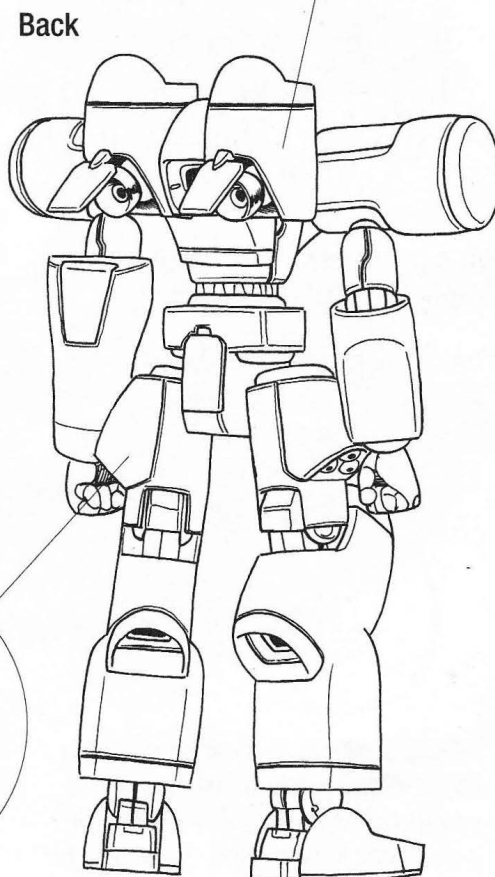
Shield



Main thruster (Note 3)



Leg harness



Back



Secondary thruster

Adding various parts to your robots will make them more impressive. By all means, equip your robots properly.

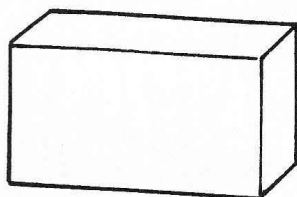
Note 1: Armor—the robot's protective covering

Note 2: Backpack—a collective term referring to thrusters worn on the back: the thruster is contained within the backpack unit.

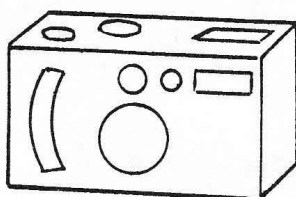
Note 3: Thruster—a small rocket used to propel an object forward

## 5 Draw in the Details

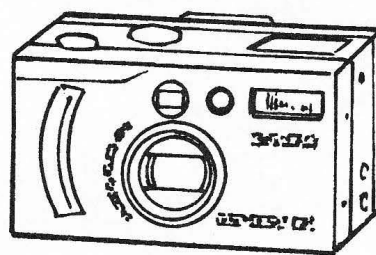
Once you have established the general form, draw the details. The addition of extra circles, squares, lines, and other small touches helps create a more convincing machine.



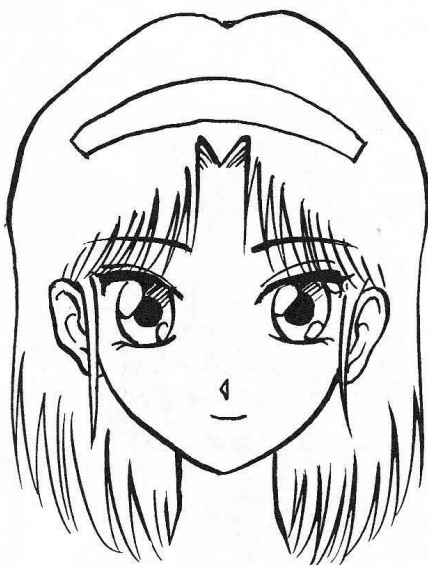
Start with simple rectangular solid.



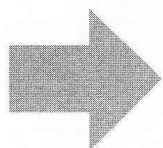
Add a few details.



Presto! A camera

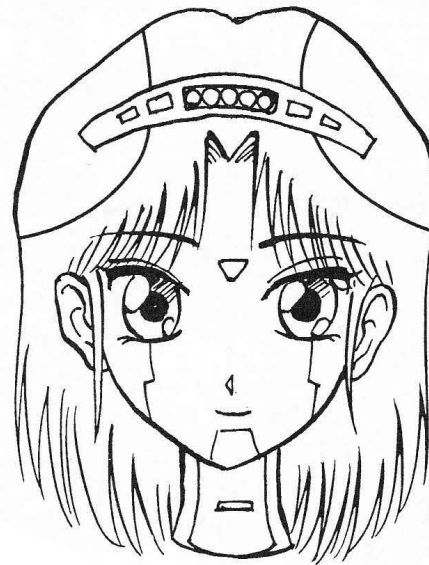


Transform a girl



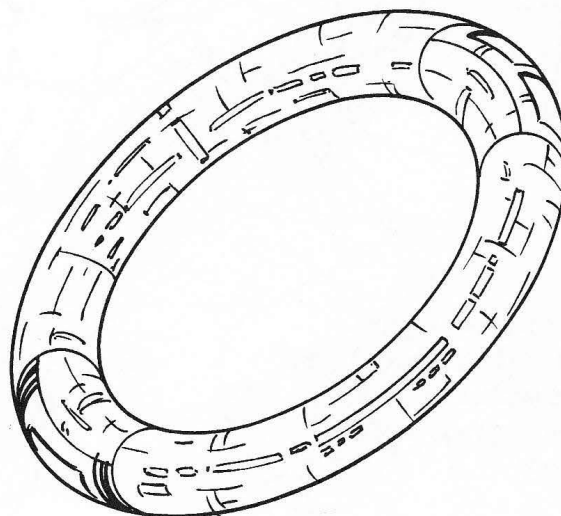
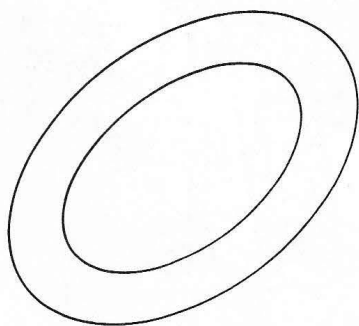
Into an android

Merely the addition of strategic lines in the girl's face and hair makes her take on a robotic appearance.



**You can transform anything simply by adding details.**

Is this an inner tube? A doughnut?



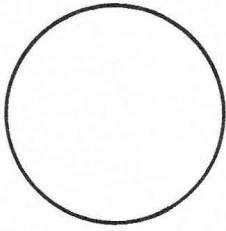
Adding details to an inner tube-looking object allows you to transform it into a space station. So long as you maintain a clear idea in your mind, you should be able to draw anything.

**From a plain inner tube to a space station?!**

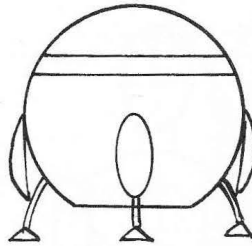


## From Circle to Spaceship

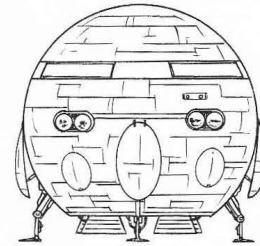
Well then, let's now go over this simple process while imagining a circle being transformed into a spaceship.



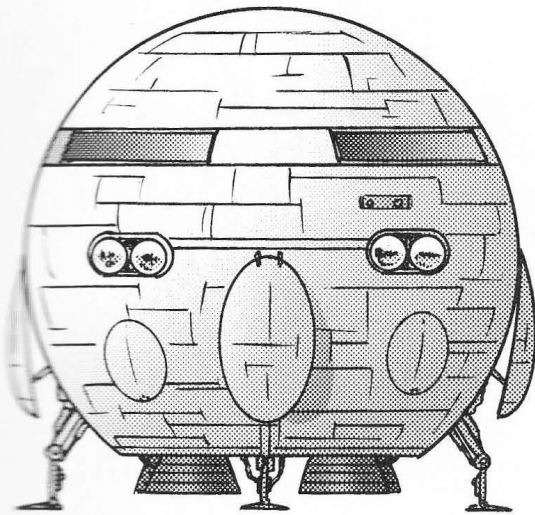
First, draw a circle.



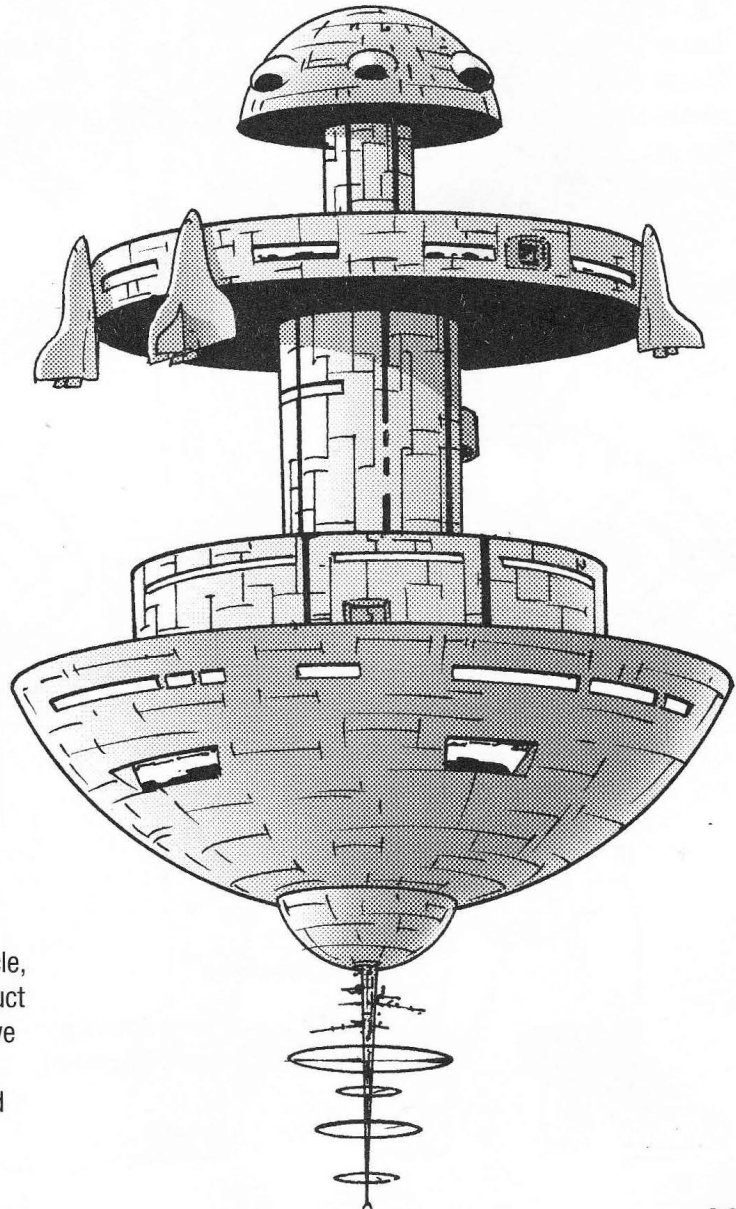
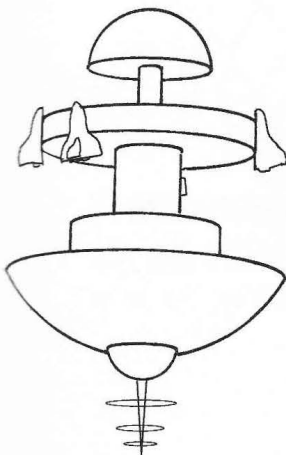
Next, we draw lines for windows and add legs to make it look more like a spaceship.



Then, we add lights and jet nozzles and curved horizontal and vertical lines to make our circle look like a sphere, transforming it into a spaceship.



Finally, we add screen tone, and now we have completed our spaceship, which no longer looks remotely like a circle.



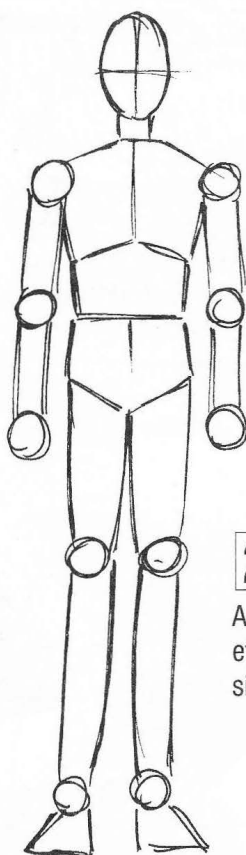
Whether your launch point is an inner tube or a circle, the addition of details will make your finished product look like your intended objective. Consequently, if we start with the general form of a large-scale space station and add details, our result is a more evolved and complex station. The figure above shows the basic form without details. The figure to the right shows the final space station with details.

# Drawing a Female Android Using the Five-Step Process

A female android can be created using the five-step process.

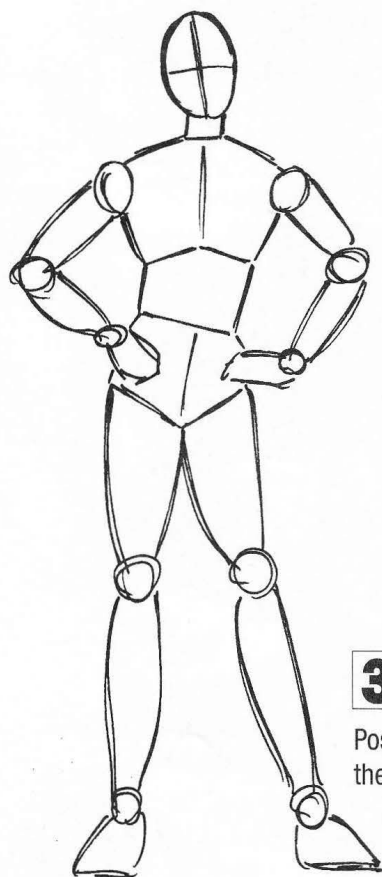
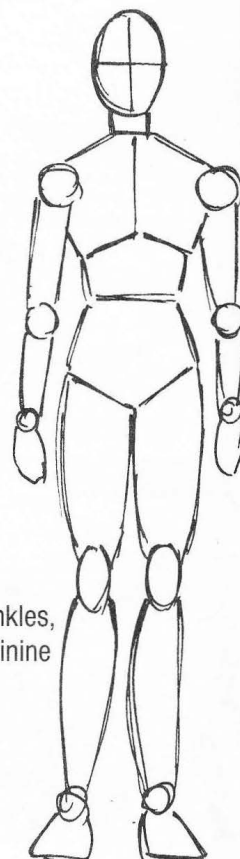
## 1 Put Together Various Geometric Shapes

Just as you would when drawing a human, divide the figure into the various parts: a head, chest, abdomen, legs, arms, and joints in a form similar to an artist's mannequin.



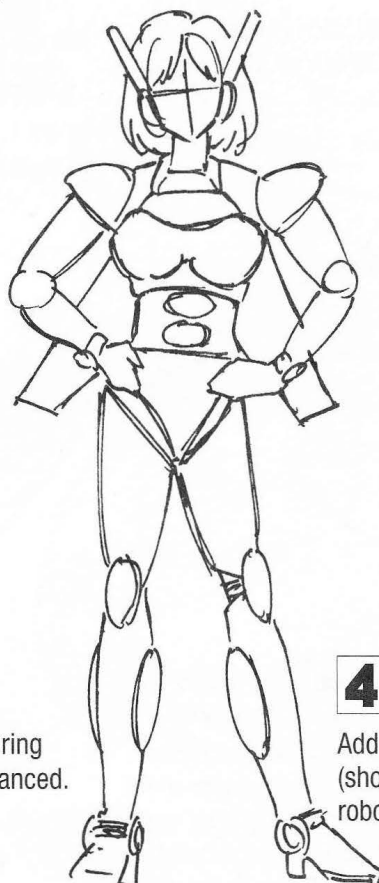
## 2 Trim the Shapes

Adjust the shapes of the waist, ankles, etc., giving the figure a more feminine silhouette.



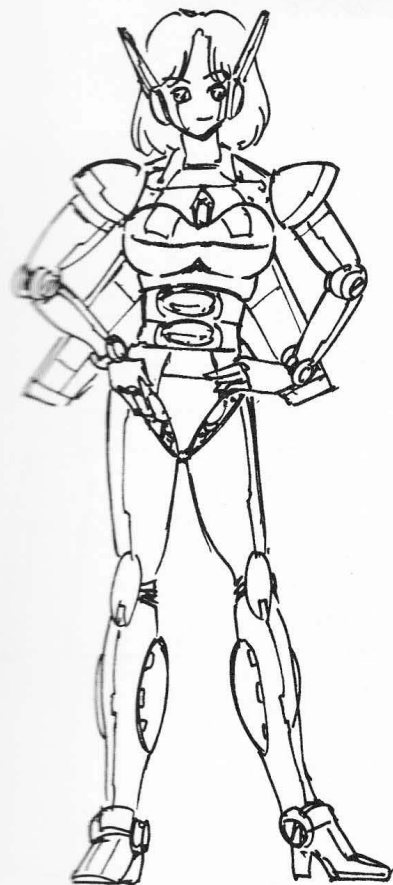
## 3 Transform

Pose the figure, while ensuring the composition is well balanced.



## 4 Add Parts

Add wings, spaulders (shoulder pads), and other robot-like armor.

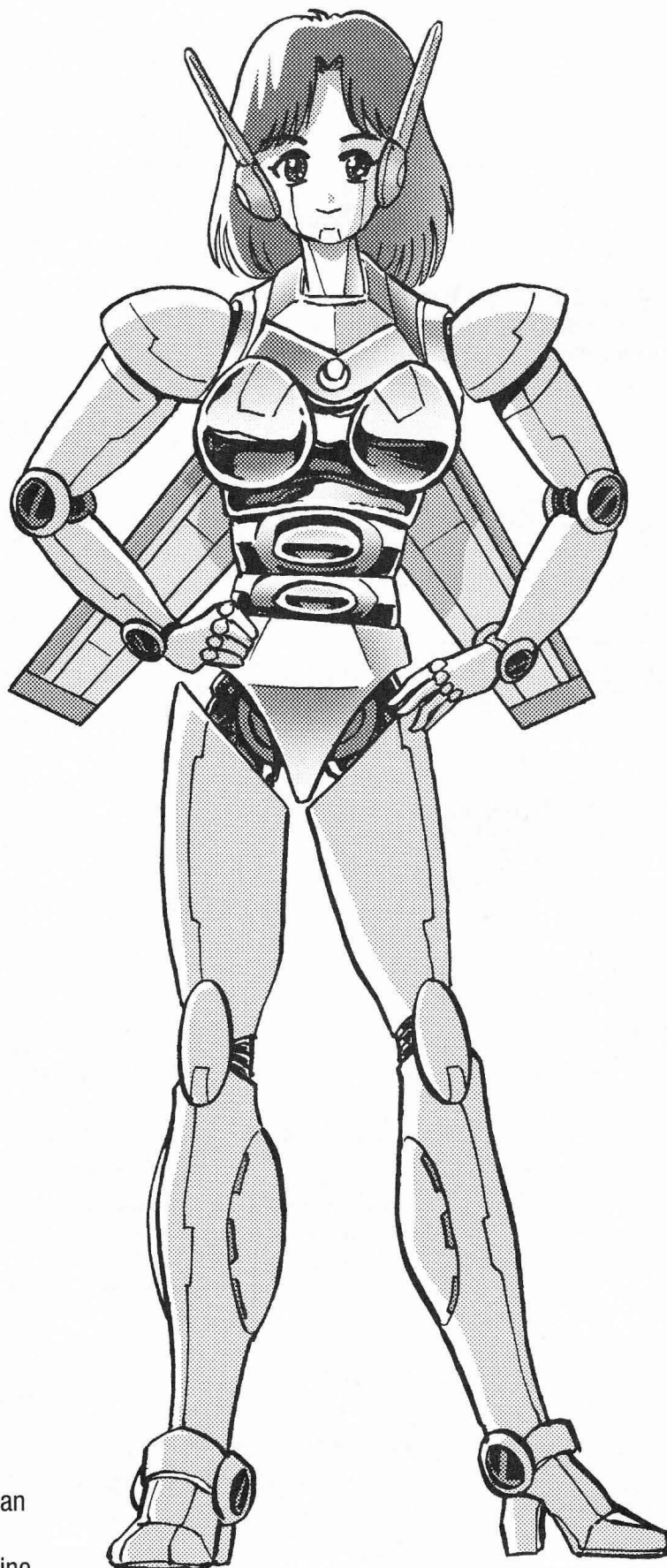


## 5 Draw in the Details

Draw the facial features, joints, and other details to complete the android.

## Final touches

Spot blacks, add screen tones, and you're done!



As illustrated on these pages, you can draw anything using this five-step process, be it an android or a machine.

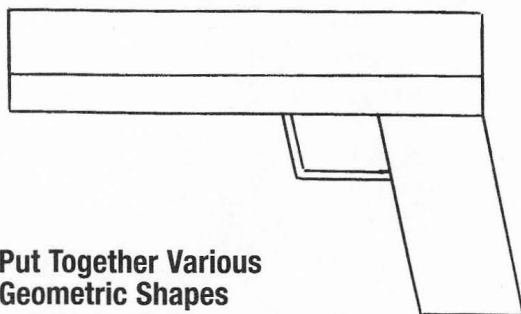


# Drawing a Handgun Using the Five-Step Process

Now let's try drawing a handgun—a common prop in manga.

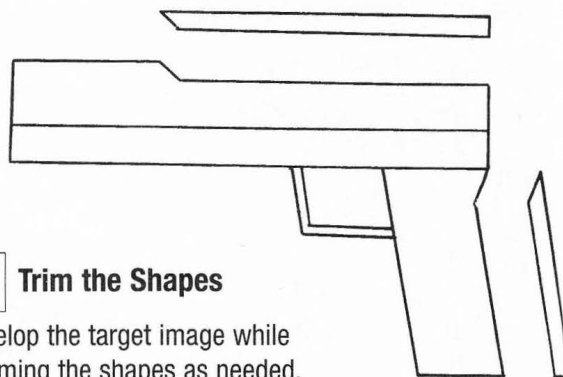
## 1 Put Together Various Geometric Shapes

Put together a simple gun using several rectangles.



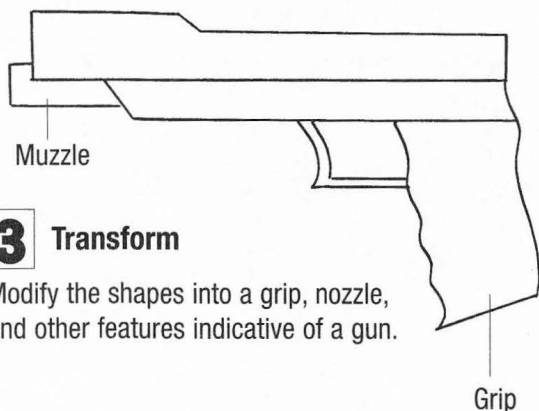
## 2 Trim the Shapes

Develop the target image while trimming the shapes as needed.



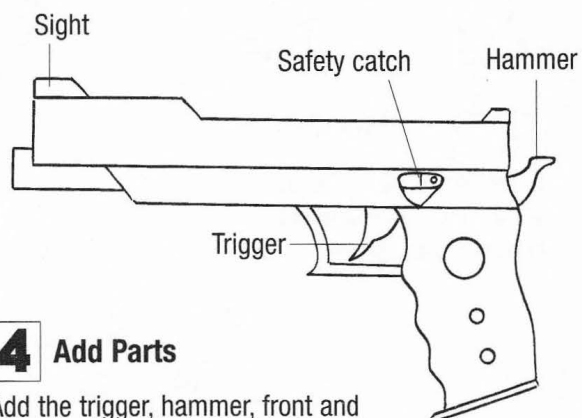
## 3 Transform

Modify the shapes into a grip, nozzle, and other features indicative of a gun.



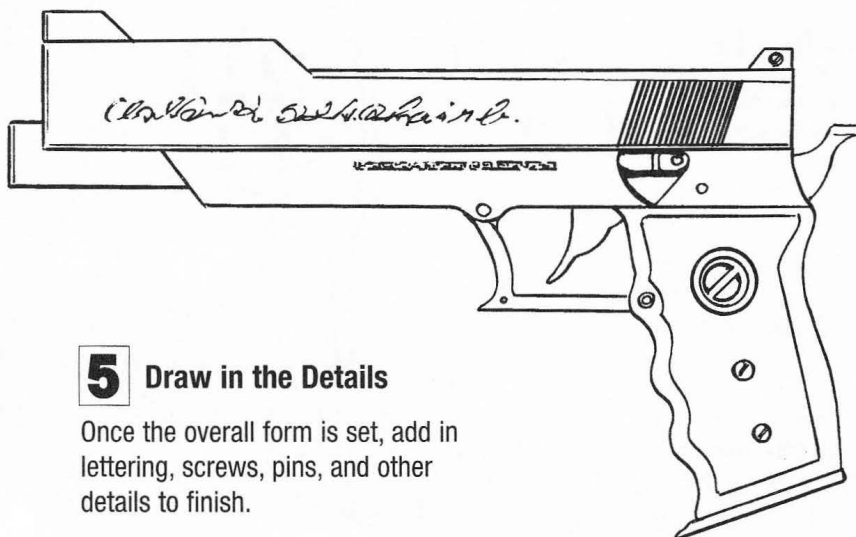
## 4 Add Parts

Add the trigger, hammer, front and rear sights, safety catch, and other supplementary parts.

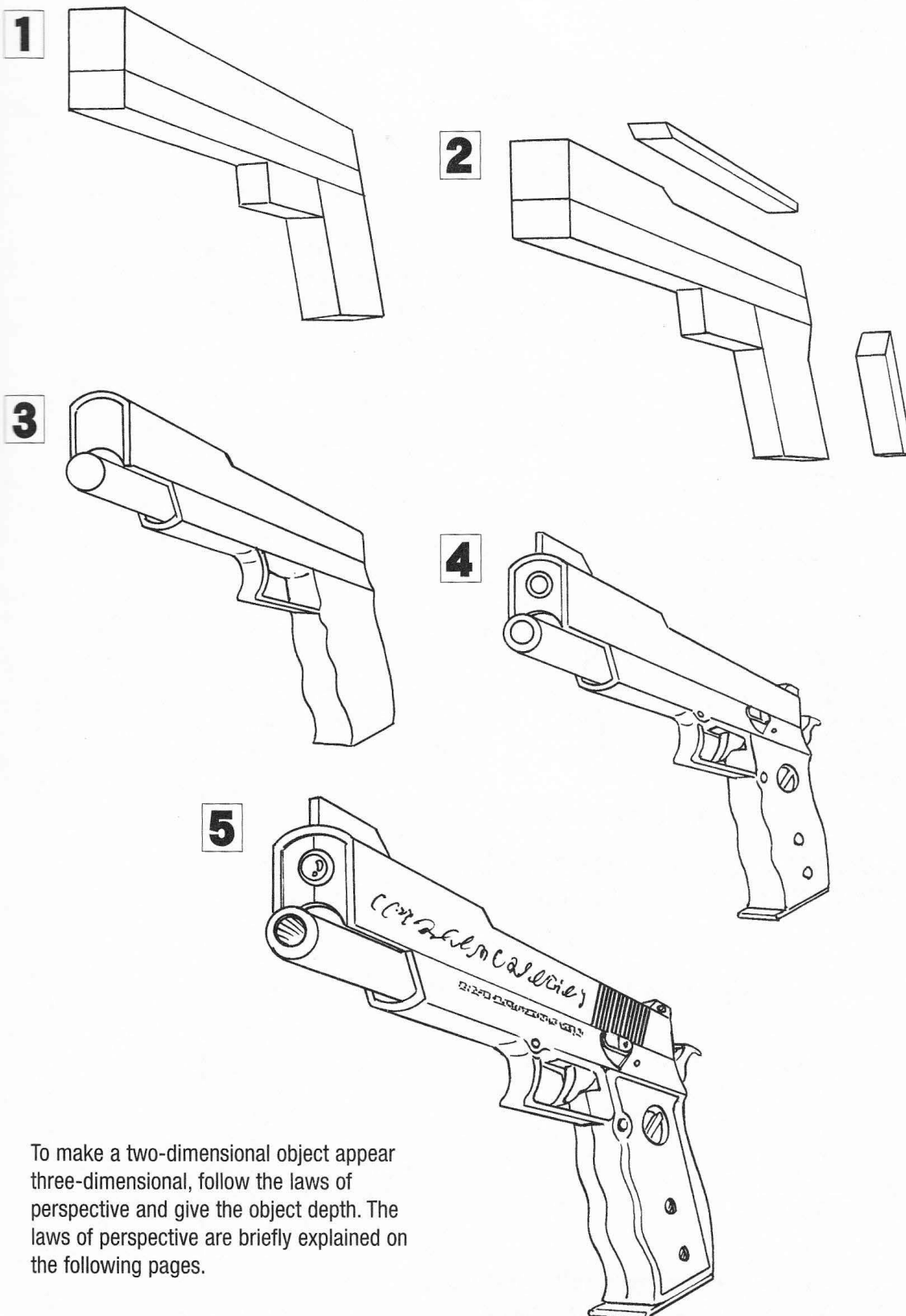


## 5 Draw in the Details

Once the overall form is set, add in lettering, screws, pins, and other details to finish.



## Drawing a Handgun from an Angle

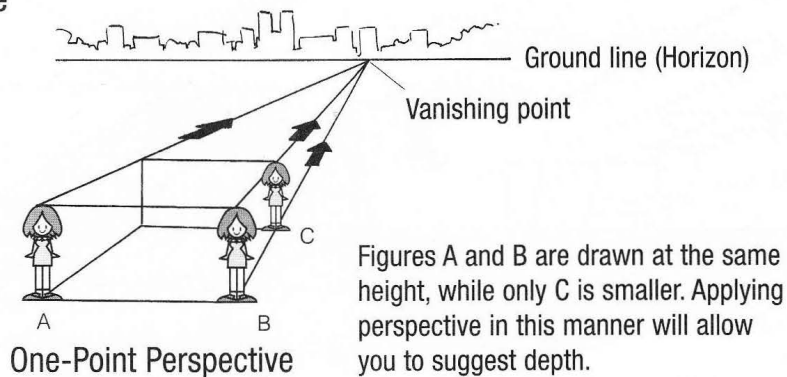


To make a two-dimensional object appear three-dimensional, follow the laws of perspective and give the object depth. The laws of perspective are briefly explained on the following pages.

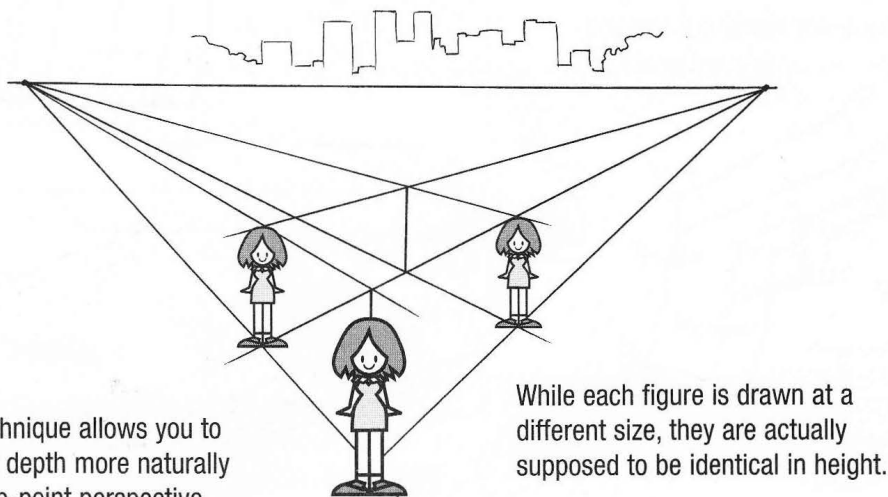
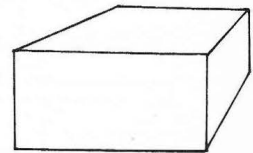
# Drawing in Simple Perspective

The laws of perspective are useful when rendering a two-dimensional object as three-dimensional. On the following pages, we discuss drawing in simple perspective.

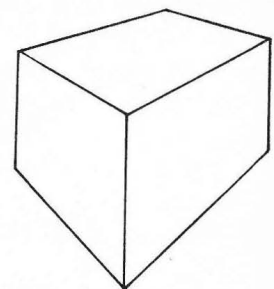
## Drawing a Cube



Cube in one-point perspective

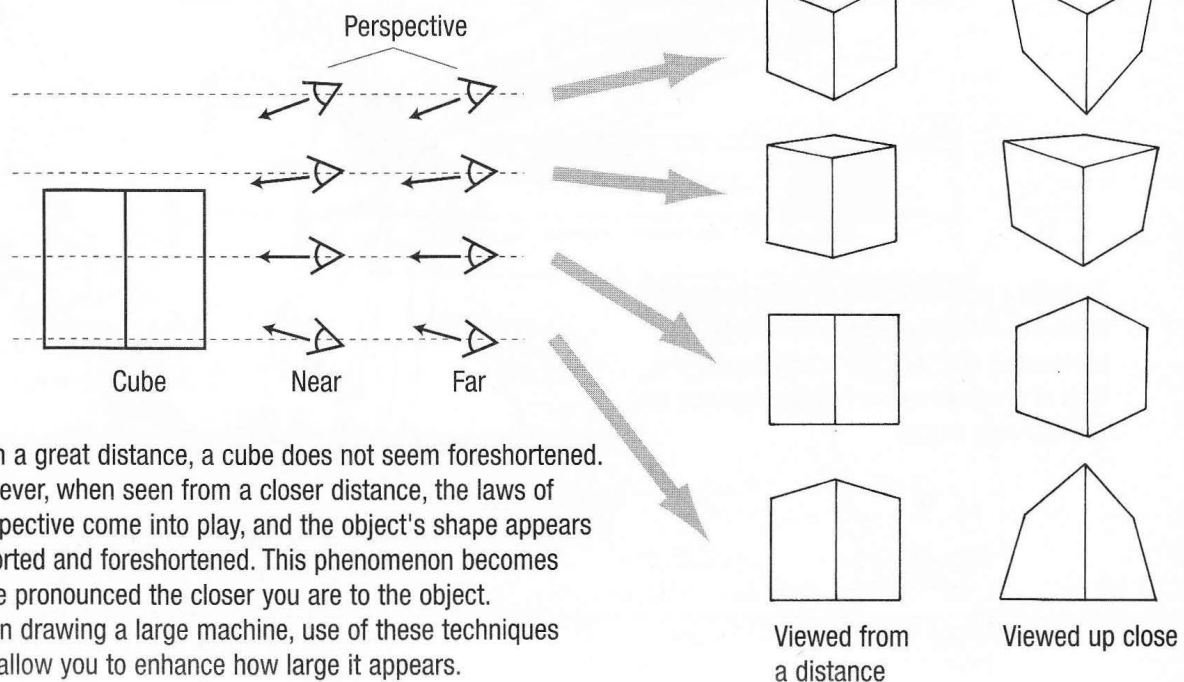


Cube in two-point perspective



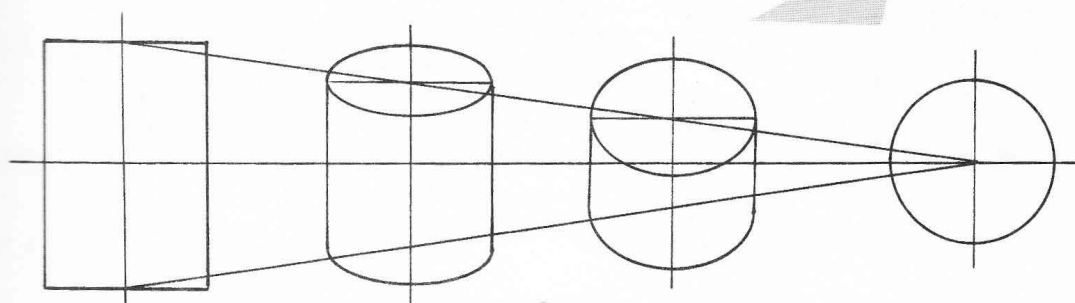
This technique allows you to suggest depth more naturally than one-point perspective.

## The way objects appear varies according to the viewer's distance from them.



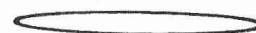
Side view

Overhead view



From the side, the cylinder appears to be a rectangle, while from overhead, it appears to be a circle. In this fashion, objects appear differently according to the angle from which they are viewed. Also note that no matter how thin, a circle's sides will never appear pointed.

Good

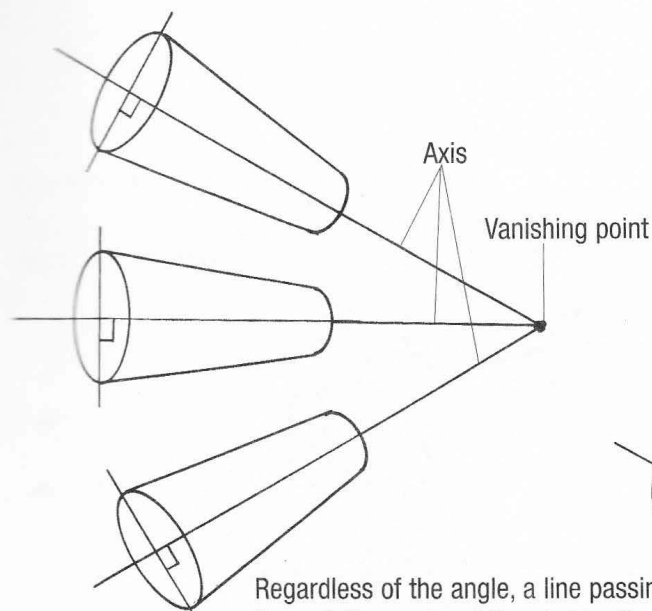
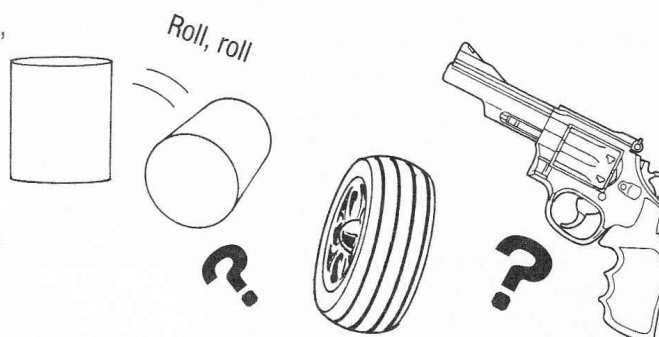


Not good



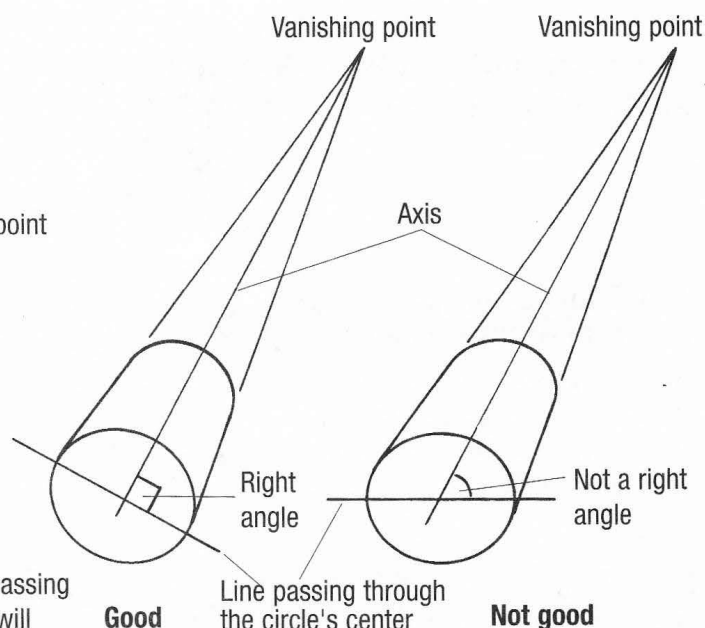
A can rolled on its side could look like a car tire or a gun barrel

Just what happens to a cylinder when drawn in perspective? Like a cube, when it is drawn directed toward a single point on the horizon (a vanishing point), the lines of the cylinder will always converge at that one point, regardless of the angle from which it is drawn. The big difference between a cylinder and a cube are that the cylinder has circular sides. Depending on the angle from which they are viewed, these circles will look like ellipses. However, a line passing through the center of the circle will always be perpendicular to the cylinder's axis, which is directed toward the vanishing point. Remember this point, as it can be applied to car tires and gun barrels.



Line passing through the circle's center

Regardless of the angle, a line passing through the center of the circle will always fall perpendicular to the cylinder's axis, which is directed toward the vanishing point. Applying this rule, a can drawn long and narrow becomes a gun barrel, and drawn short and thick becomes a car tire.



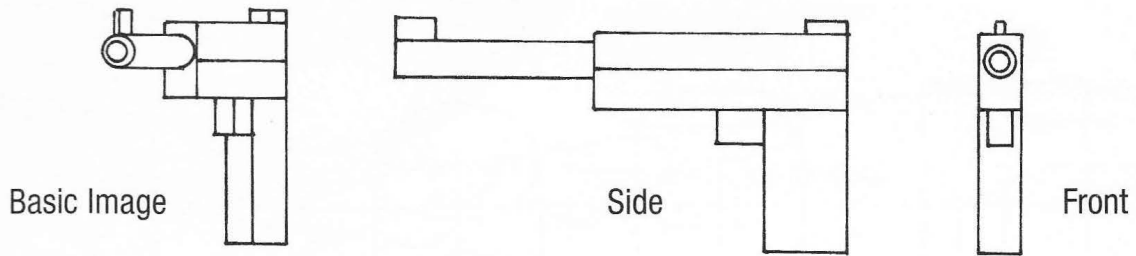
Good

Not good

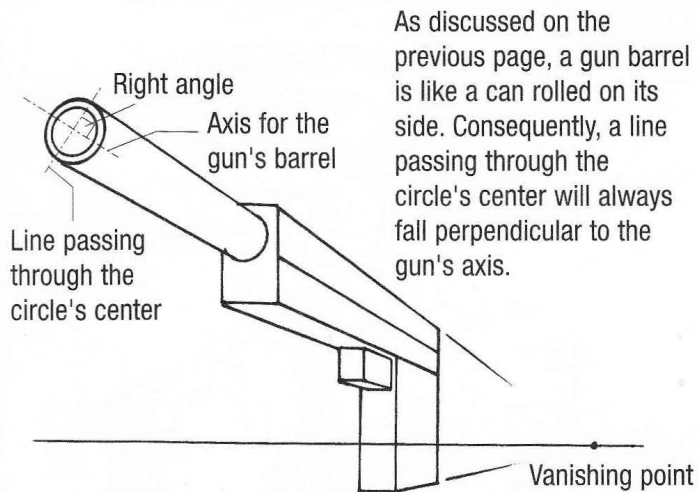
In the figure above, the line passing through the center of the circle does not form a right angle with respect to the cylinder's axis. This is an easy mistake to make, so be careful.



# Drawing a Handgun in Perspective

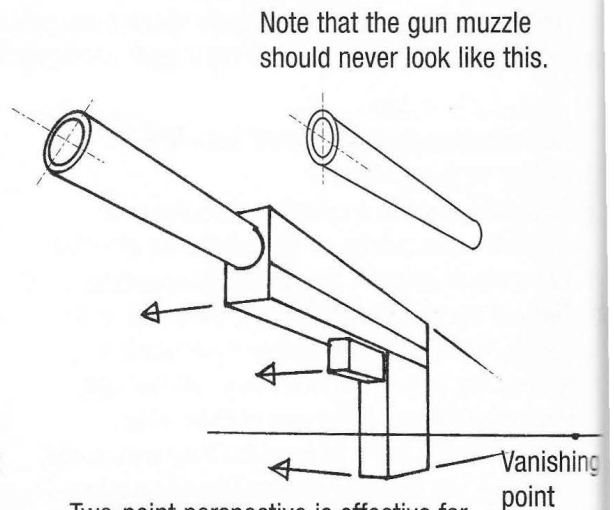


## Handgun in One-Point Perspective



Compared to the basic image, the gun drawn in one-point perspective has depth and greater visual impact.

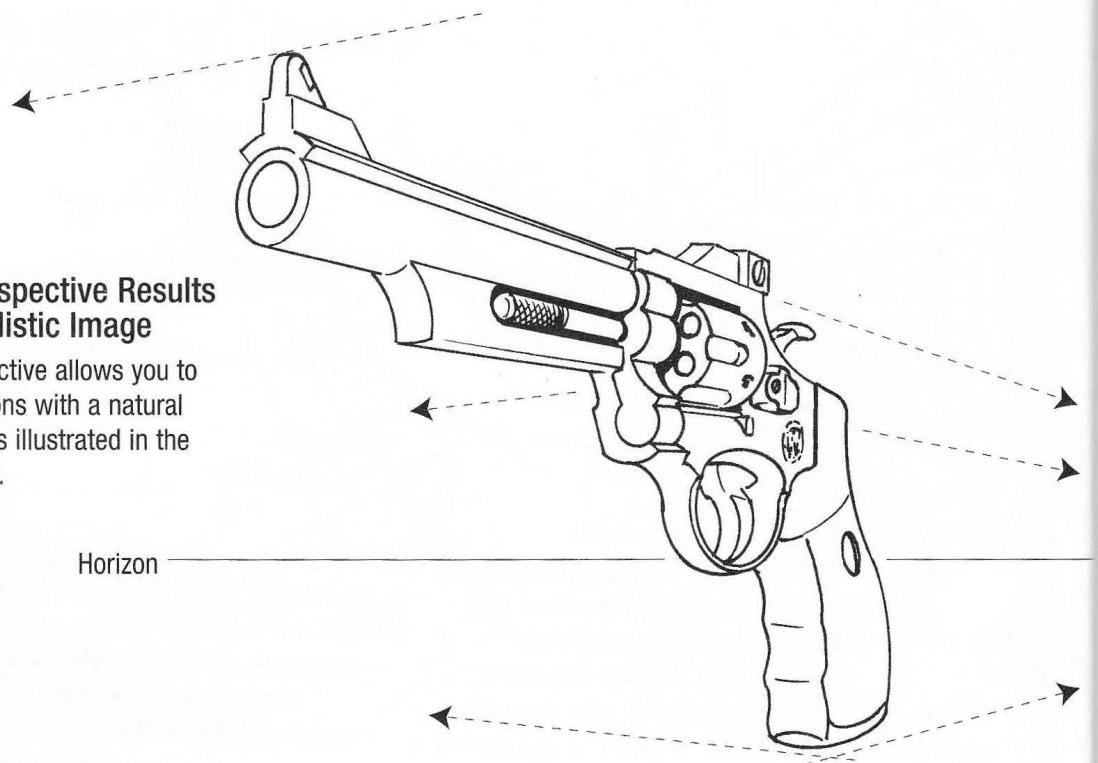
## Handgun in Two-Point Perspective



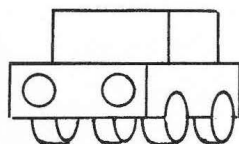
Two-point perspective is effective for making powerful scenes, like that of a gun firing, all the more dramatic.

## Two-Point Perspective Results in a More Realistic Image

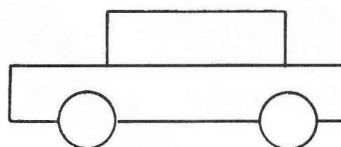
Two-point perspective allows you to create compositions with a natural sense of depth, as illustrated in the figure to the right.



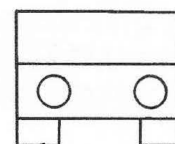
## Drawing a Car in Perspective



Basic Image

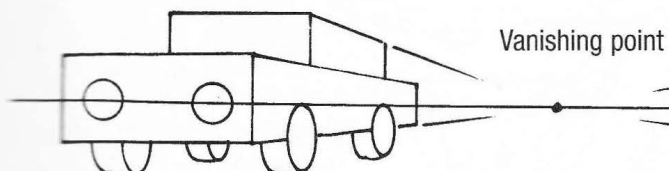


Side



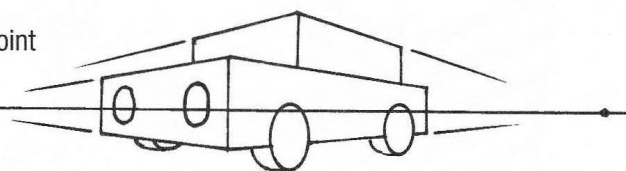
Front

### Car in One-Point Perspective



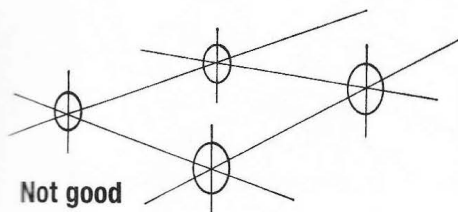
Here, the car appears to be moving toward the viewer.

### Car in Two-Point Perspective



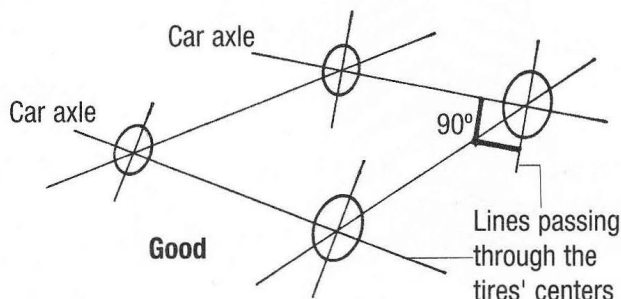
When an object has sufficient breadth, like a car, two-point perspective can enhance the sense of depth.

### Common Mistake (Tire Angles)



Not good

When drawn in perspective, a line drawn through the centers of the car's tires should rarely be vertical.

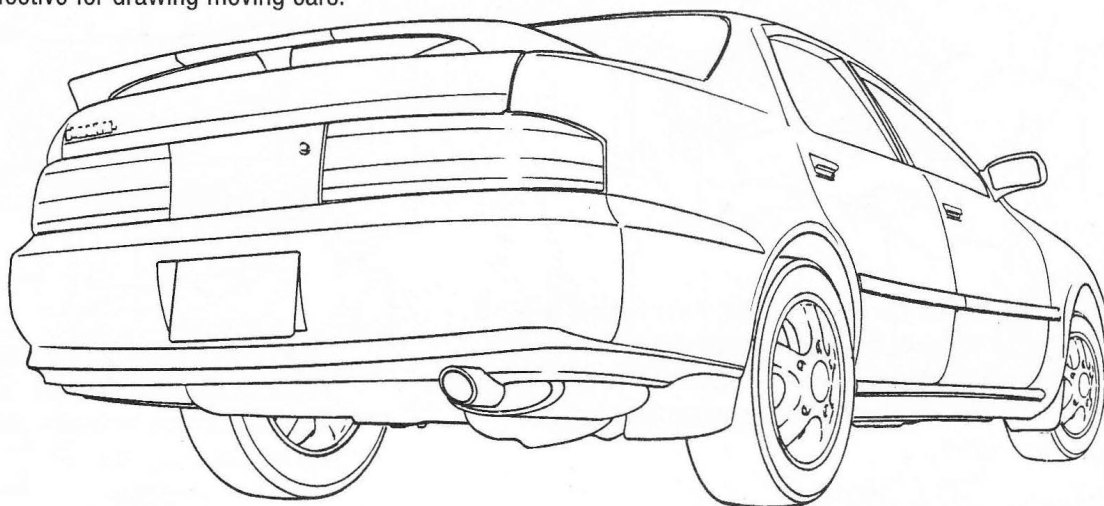


Good

To draw the tires, these central lines should intersect with the car's axles at right angles.

### Car Drawn in Two-Point Perspective

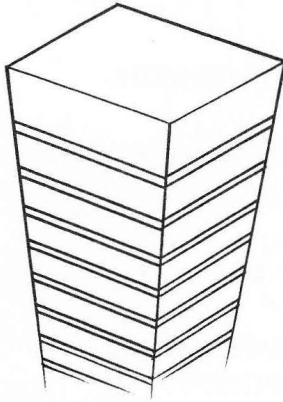
Since two-point perspective allows you to suggest depth, it is effective for drawing moving cars.



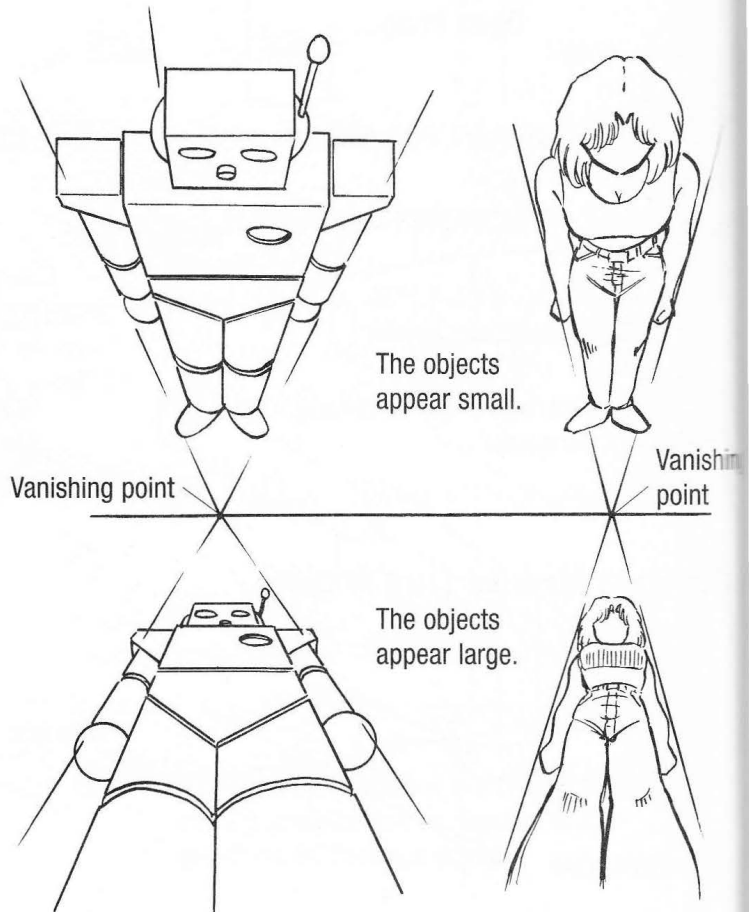
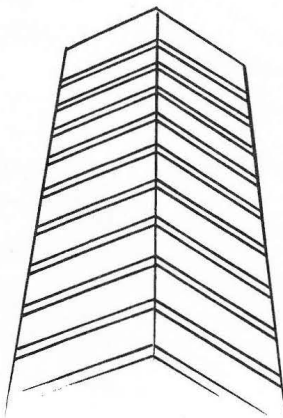
## Making Machines Look More Dynamic by Using High and Low Angles

Objects appear smaller when viewed from overhead and bigger when viewed from a low angle. This is because we tend to judge the size of other objects based on the height of our own eyes.

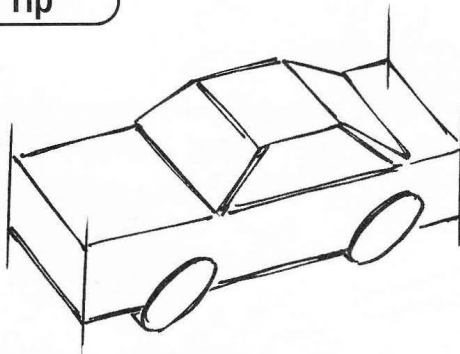
Building from a high angle



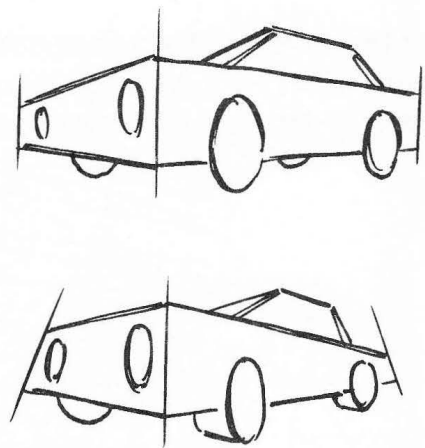
Building from a low angle



### Tip



When drawing from a low or high angle, if the subject is not something that naturally has much height, there is no need to draw it in perspective (i.e. use foreshortening). It is more effective to use foreshortening to exaggerate the size of an already large object.



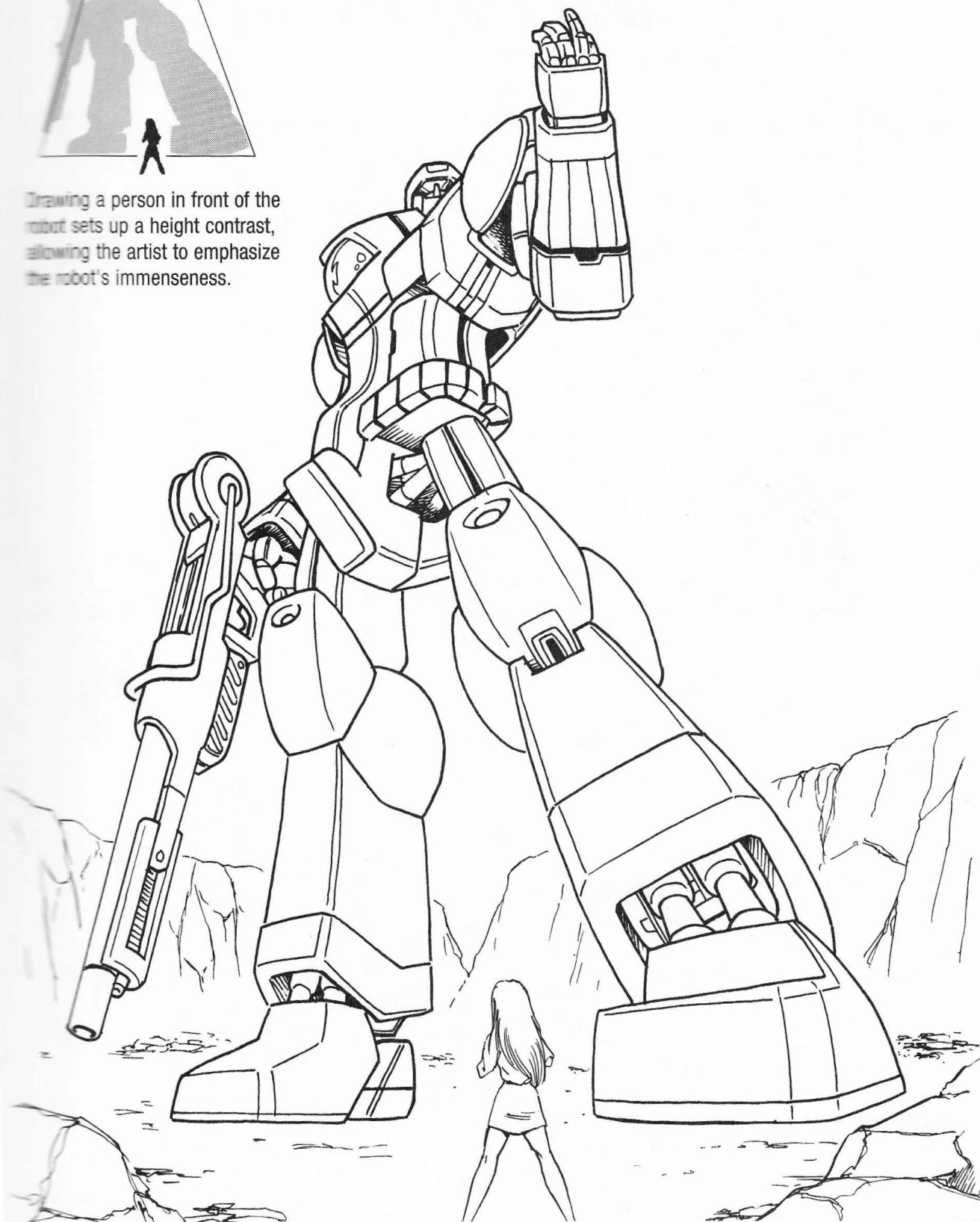
Forced use of foreshortening will cause the subject to appear unnaturally distorted. This is not an effective technique, except under very special circumstances.

### Tip

Picturing a triangle when drawing helps objects to fall naturally into perspective vertically, and it allows you to emphasize their sizes.



Drawing a person in front of the robot sets up a height contrast, allowing the artist to emphasize the robot's immenseness.

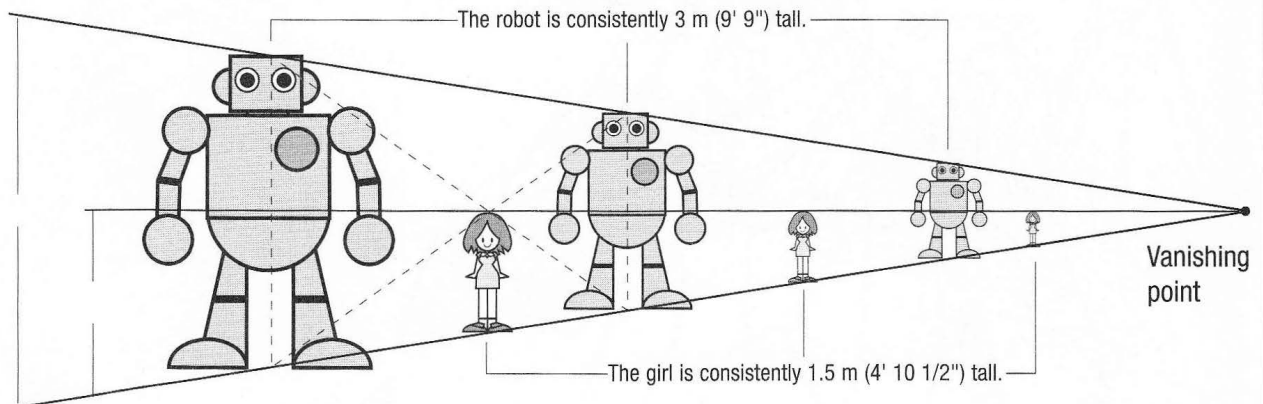
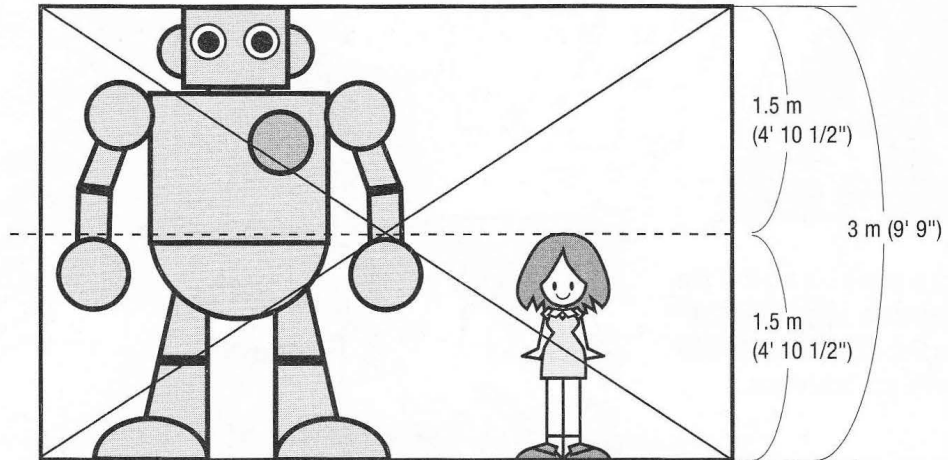




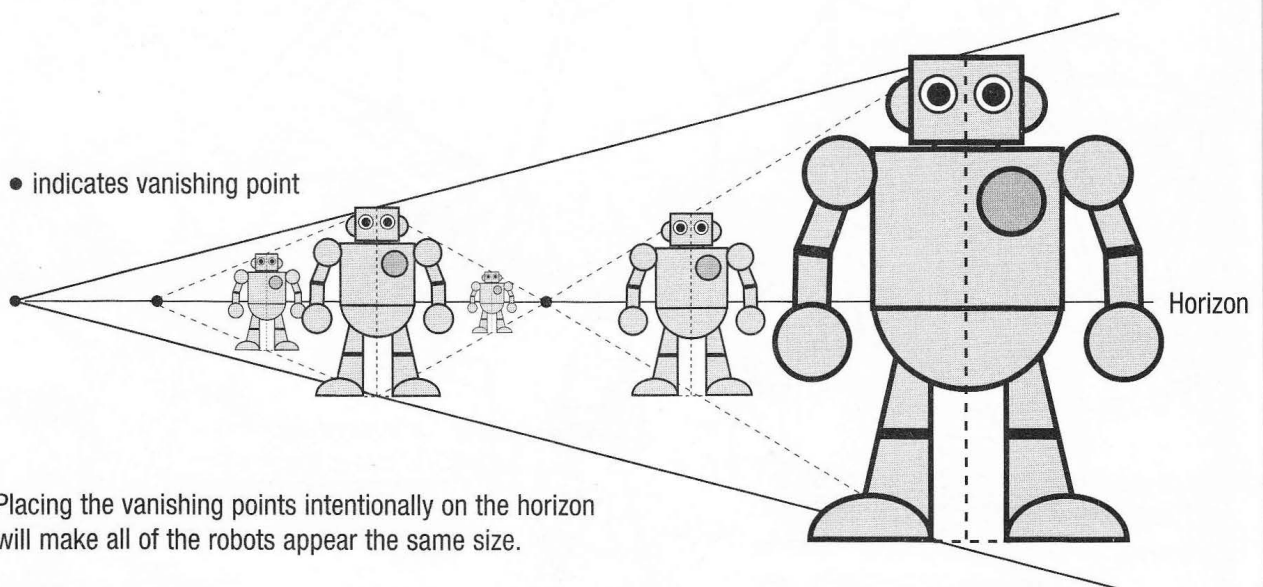
## Matching up Heights

It is essential from a compositional perspective that the background and characters' heights be matched. Using perspective allows you to match objects' heights easily.

Two bisecting lines  
(and a center line)

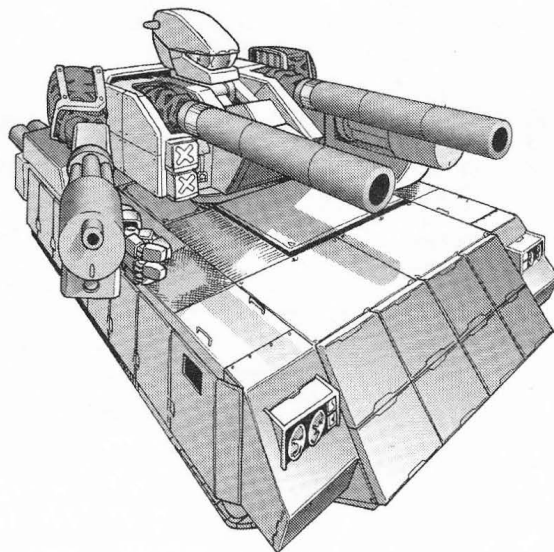
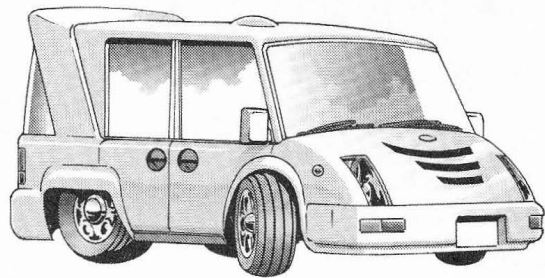
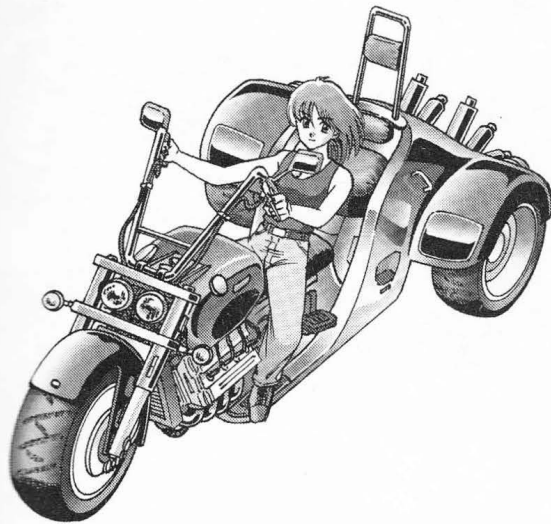


• indicates vanishing point



# Chapter 3

## Key Techniques in Rendering Mecha According to Function (Land or Air Mobile)

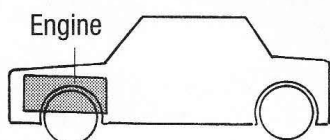
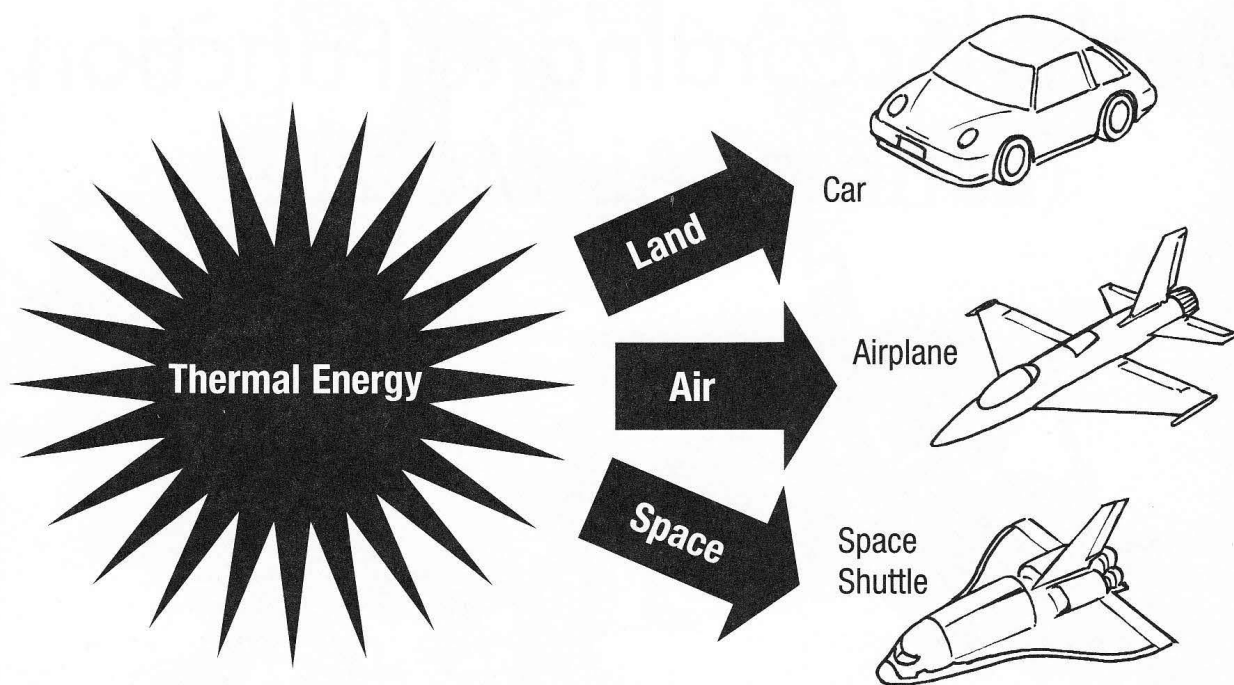


## Movement Begins with an Explosion

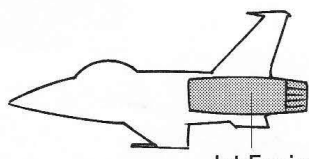
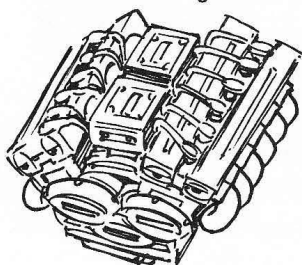
With the exclusion of special, electrically powered machines, cars, motorcycles, airplanes, and rockets all have engines. An engine is a machine used to convert explosions into movement. The combustion of gasoline and other fuels causes the expanding energy (thermal energy) to be converted into motion. Thus, machines' movement arises from explosions occurring inside their engines.

### ● Engines

The form of an engine varies according to its purpose. However, engines can be divided into three general types: engines designed to propel cars, motorcycles, and other land vehicles; jet engines designed to propel aircraft; and rocket engines, designed to propel spacecraft.



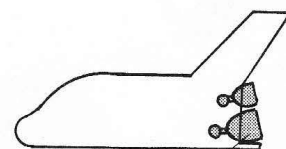
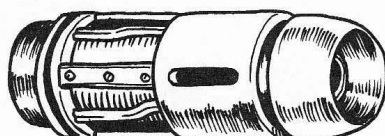
Motion generated from combusting a mixture of gasoline and air is channeled to the tires, making them move over the ground.



Jet Engine

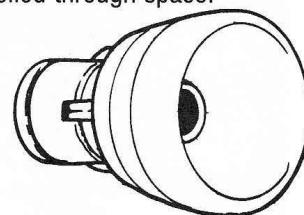
Jet fuel is combusted, generating thrust, producing lift for the wings, thus allowing it to fly.

\*See page 69 for a discussion of lift power.



Rocket Engine

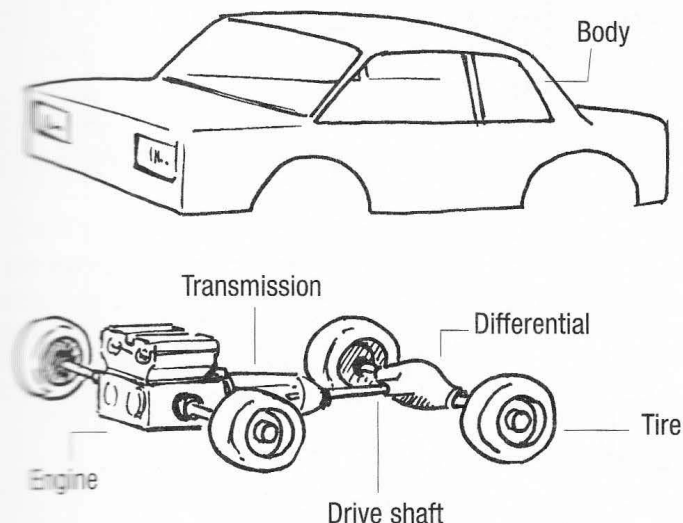
This engine causes a reaction (combustion) between liquid oxygen and hydrogen, generating thrust, allowing for the vehicle to be propelled through space.



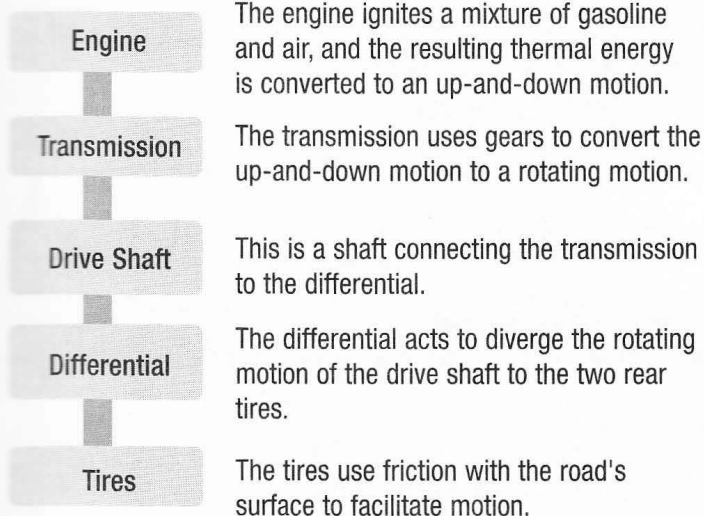
# How an Engine Works

Here, is a brief discussion of how the thermal energy generated inside an engine is converted to motion.

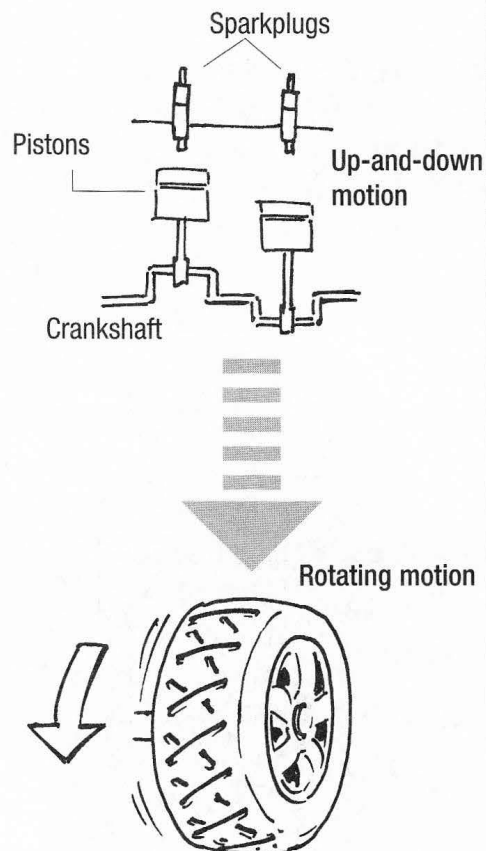
## How Cars Move



## The Kinetic Process

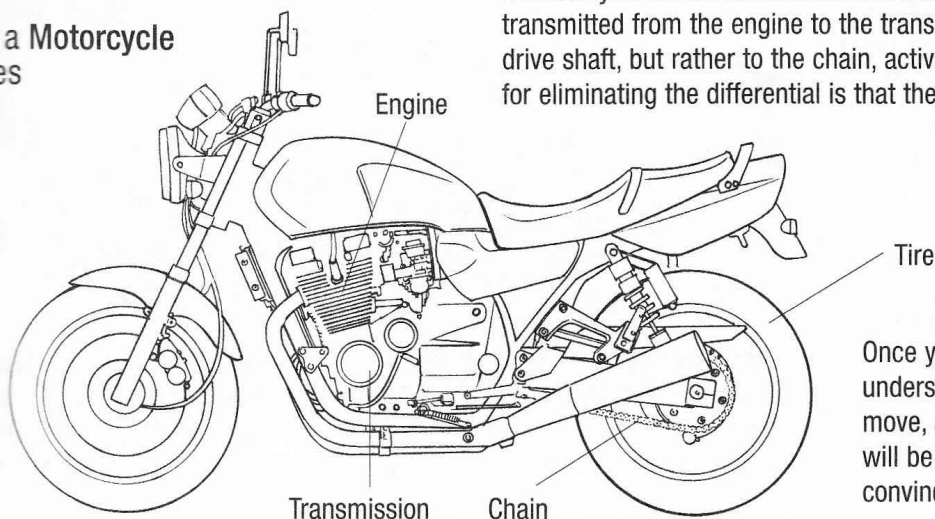


## The Engine's Interior



When the engine is running, the crankshaft converts the up-and-down motion of the pistons into a rotational movement at the tires. The tires then use resistance caused by friction with the ground to allow movement.

## How a Motorcycle Moves



A motorcycle differs somewhat from a car, in that the motion transmitted from the engine to the transmission is not passed to the drive shaft, but rather to the chain, activating the tires. The reason for eliminating the differential is that there is only one rear tire.

Once you have a basic understanding of how machines move, as is reviewed here, you will be able to draw them more convincingly.

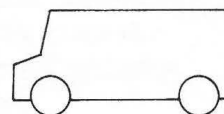


## Drawing Comfortable, Boxy Cars: Minivans

Minivans are boxy cars designed to allow for an increased number of passengers and cargo load. While minivans do come with increased air resistance, they also have comfortable rides

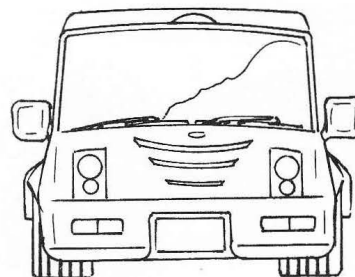
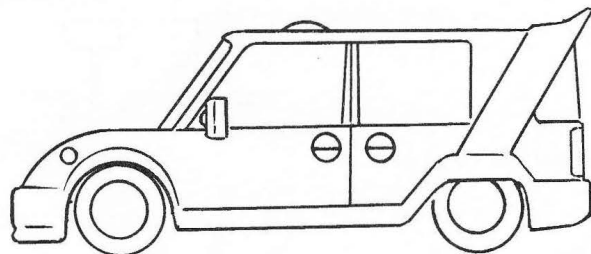


Boxy shape

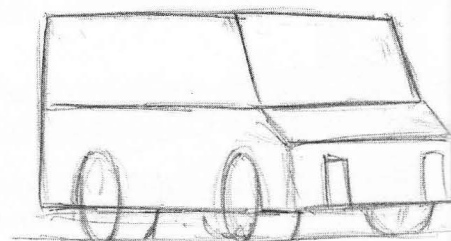
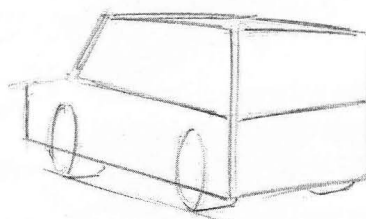
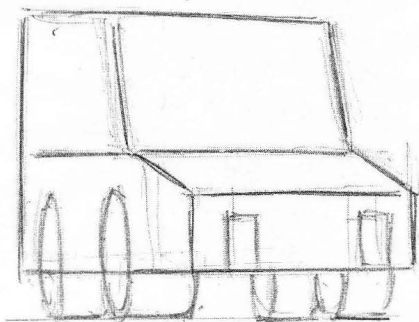


### Visualize the Design

You can portray a sense of comfort and stability by drawing a large cabin and windows.

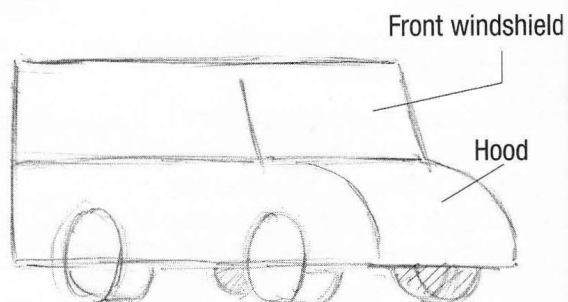
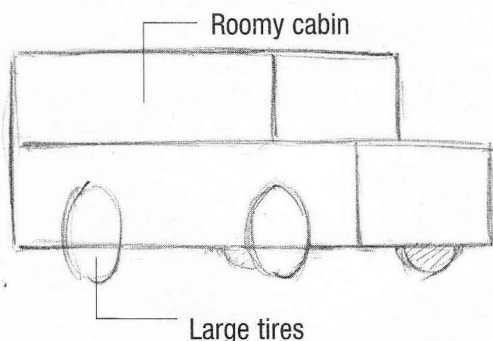


### Devise the Composition



Try designing a composition that illustrates a stable, secure vehicle being driven. A simple sketch will suffice.

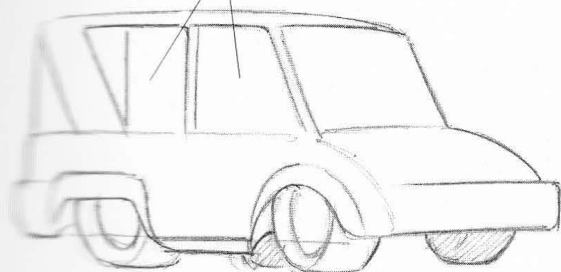
### Imagine the Functions Associated with Driving on Land While Drawing a Minivan Following the Five-Step Process



① Since a minivan comprises a combination of geometric shapes, jot down a simple basic image. At this time, make the cabin spacious and the tires large in order to create a sense of roominess. This will result in a more stable form for your car.

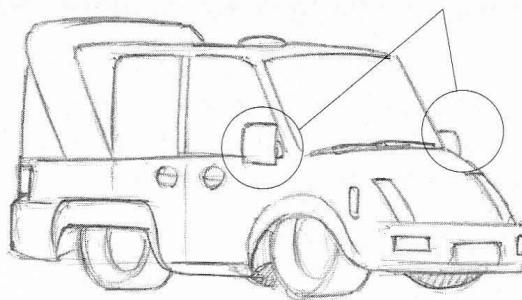
② Adjust the form. Trim the geometric shapes, creating the front windshield, hood, and other recognizable car parts. Make significant cuts to the original geometric shapes, especially to create the hood, in order to allow the driver a wide, sweeping view.

Large side windows

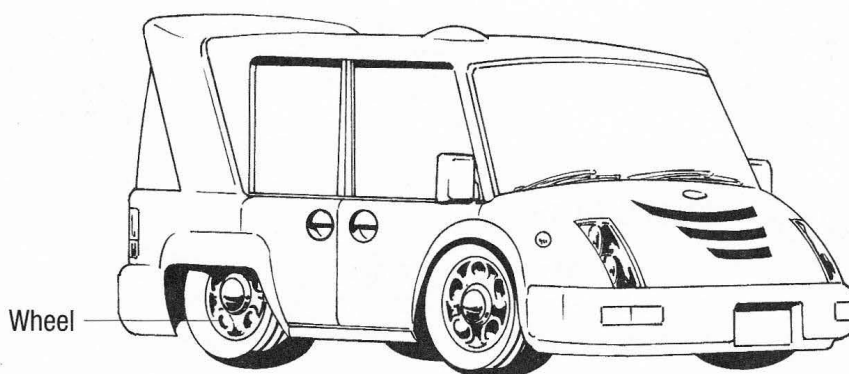


③ Add protrusions and indentations where needed and give the van a certain degree of volume. Also, drawing the side windows on the large side allows for greater visibility from the cabin, projecting an air of comfort.

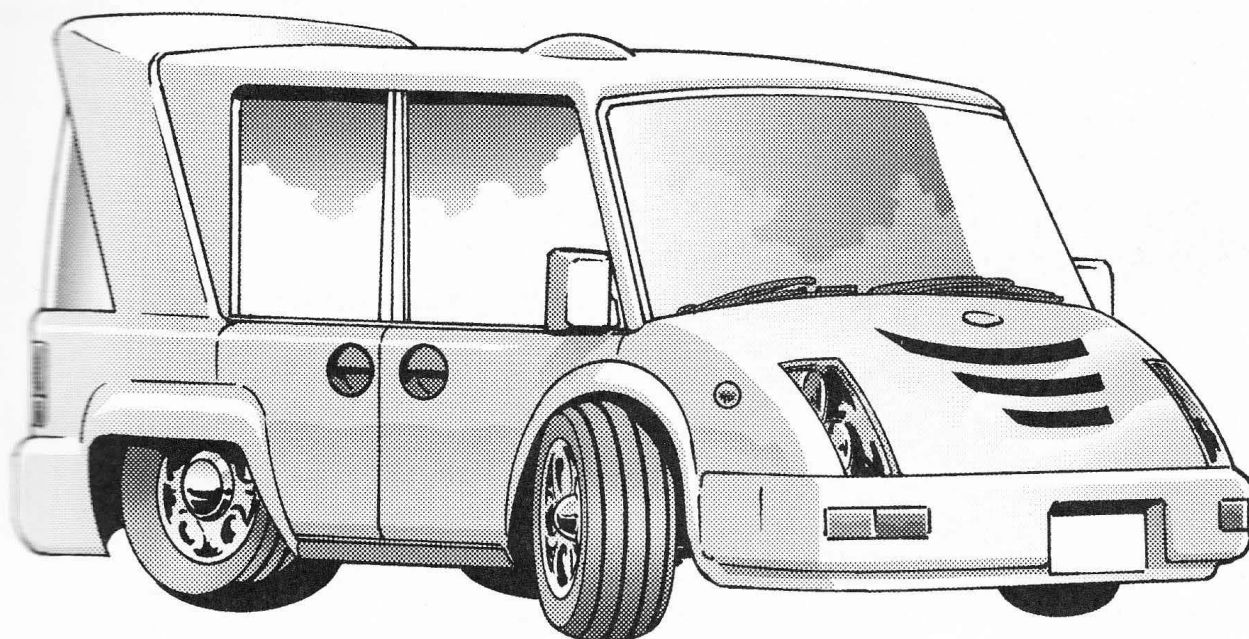
Generous side mirrors



④ Roughly add lights, mirrors, and other necessary supplementary parts. Mirrors are especially important, as they allow the driver to see what's going on toward the back, so they should be made large.

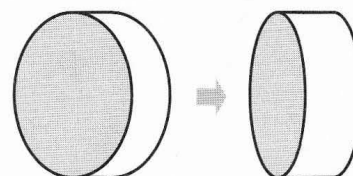


⑤ Add in lines to define the doors' and wheels' interiors and other details to complete the van.



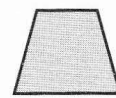
⑥ By changing the positions of the tires and omitting the steering wheel, you can suggest the minivan is negotiating a curve.

Drawing the tire less thick indicates to the viewer that its position has shifted.

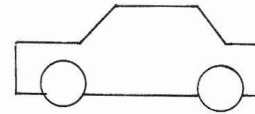


## Using Depth to Portray a Comfortable Ride: Sedans and Coupes

Sedans and coupes, which have balanced passenger to cargo space, come in an evenly proportioned, trapezoidal shape. These cars have an average amount of wind resistance and allow for a comfortable ride.

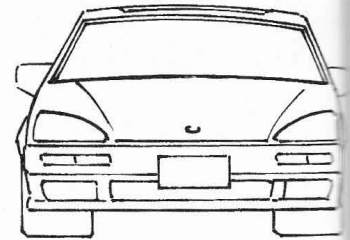
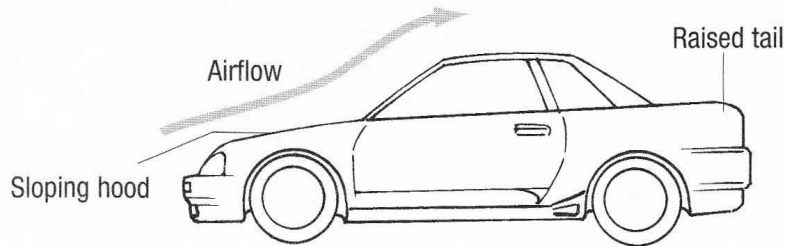


Trapezoid



### Visualize the Design

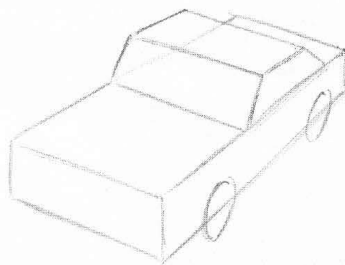
The forward sloping hood serves to reduce wind resistance, optimal for a comfortable ride..



### Devise the Composition and Draw the Car

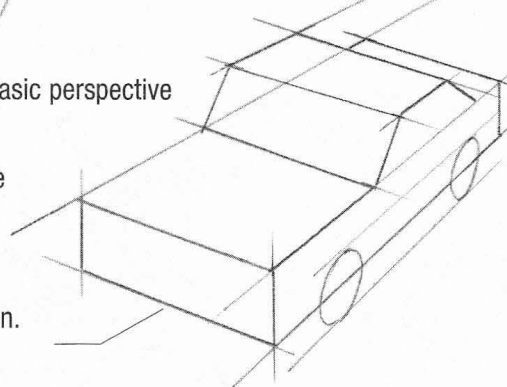
#### One-Point Perspective

Play around with what sort of composition in simple perspective will convey the appropriate speed. Even one-point perspective should give you a composition with sufficient depth.



① Basic perspective

Drawing the horizontal lines of the car at an angle (with respect to the horizon) results in a satisfying composition.

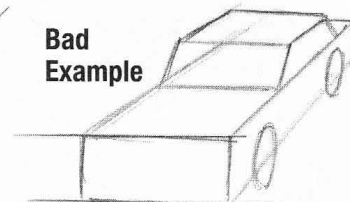


Horizon

Vanishing point

Approximated foreshortening can be used when the vanishing point is set far away.

#### Bad Example



Drawing the horizontal lines of the car parallel to the horizon results in an ugly car.

② Starting with the basic parts, adjust the overall form.

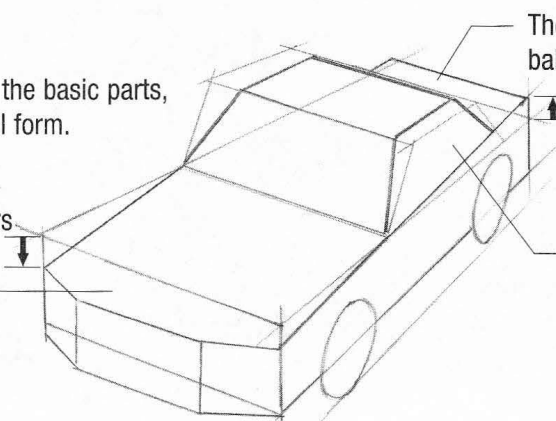
Having the hood slope forward gives a sense of stability.

The front lowers

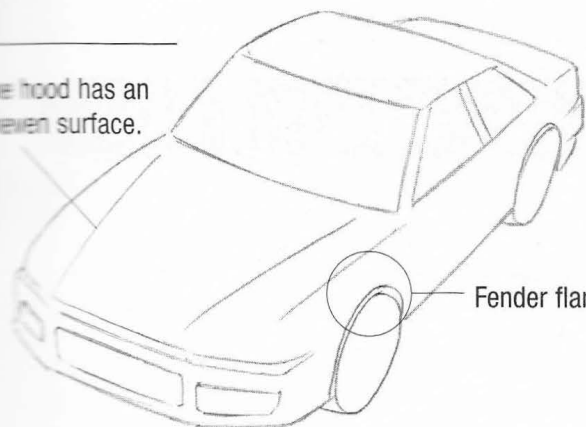
The tail is raised, visually balancing the car.

The tail rises

Tilt the side windows inward.



The hood has an uneven surface.



Fender flare

Headlight

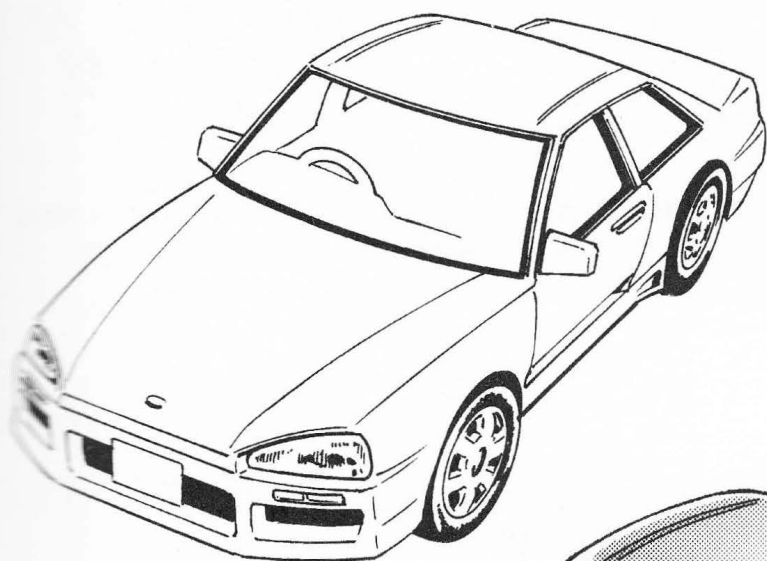
B-pillar

Side mirror

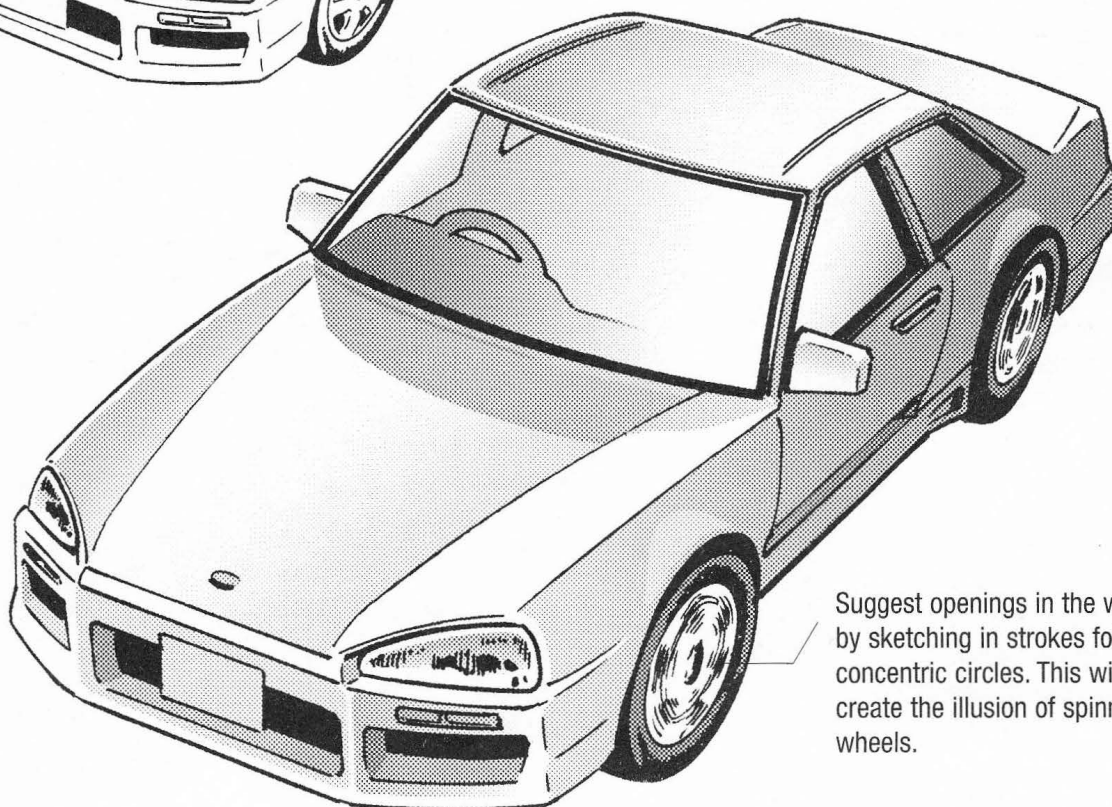
Air intakes

③ Adjust the overall form by rounding off corners and edges all over the car, adding hills and valleys to the fender and hood, and adding some unevenness to the car's surface.

④ Sketch in lights, mirrors, pillars, air intakes, etc.



⑤ Complete the overall form by adding details such as ridges to the headlights' glass surfaces, door handles, etc.



Suggest openings in the wheels by sketching in strokes following concentric circles. This will create the illusion of spinning wheels.

⑥ The illusion of spinning tires suggests the car is moving rapidly.

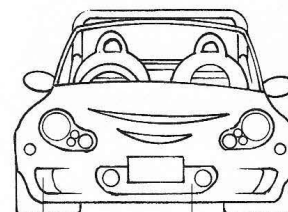
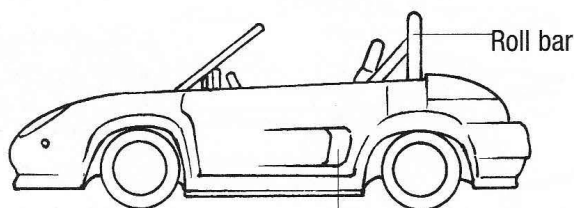
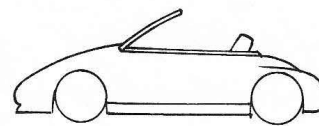
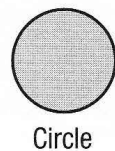


## Accentuating Rounded Lines to Suggest Speed: Sports Cars

This car seats two and has almost negligible cargo space. Its overall form is round to minimize wind resistance and allow it to travel at fast speeds.

### Visualize the Design

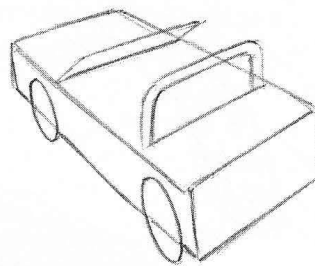
The rounded body offers little air resistance, making it suited to driving fast. Because the car travels quickly, its interior (engine, etc.) tends to heat up. Consequently, the sports car has numerous air intakes. This particular design also features a roll bar for safety purposes. Since sports cars should always look sharp, let's make this one a convertible.



### Devise the Composition and Draw the Sports Car

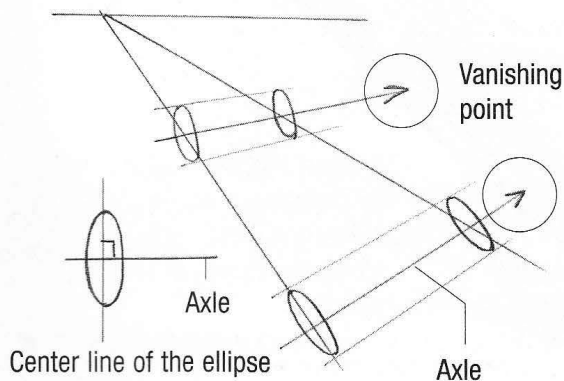
#### Two-Point Perspective

Two-point perspective results in a dynamic perspective and, consequently, allows you to enhance the sense of speed.



#### Note

Draw the ellipses used for the tires to form right angles with the tires' axes (i.e. the axles).



Draw the lines converging on a single point on the horizon. Just a general sketch will suffice.

① Basic perspective

Have the front windshield curve.

Add thickness to the door.

Round off the tail.

② Adjust the overall form. Make it round.

③ Add supplementary parts.

The side mirrors characteristic of sports cars should be round to minimize air resistance. The brake lights should be large to ensure they are highly visible. Two mufflers mean greater exhaust efficiency than one, allowing the car to travel even faster. The roll bar is an important addition that protects the driver's head if the car should roll. Keep the roll bar thick: it will make the car look zippy.

④ Draw the interior.

To finish, add supplementary parts indicative of a sports car: a stick shift, a small steering wheel, etc.

To learn about suggesting speed, refer to the sample on p. 122.

Note: Just why are sports car steering wheels small? The reason is that the smaller steering wheels allow for the driver to operate the car, which is traveling at top speeds, using a minimum of movement. In contrast, the steering wheels of spacious, boxy cars are large.

Headlight

Side mirror

Air intake

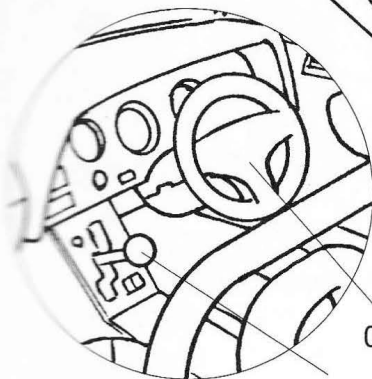
Fender flare

Brake light

Muffler (Tailpipe)

Compact steering wheel

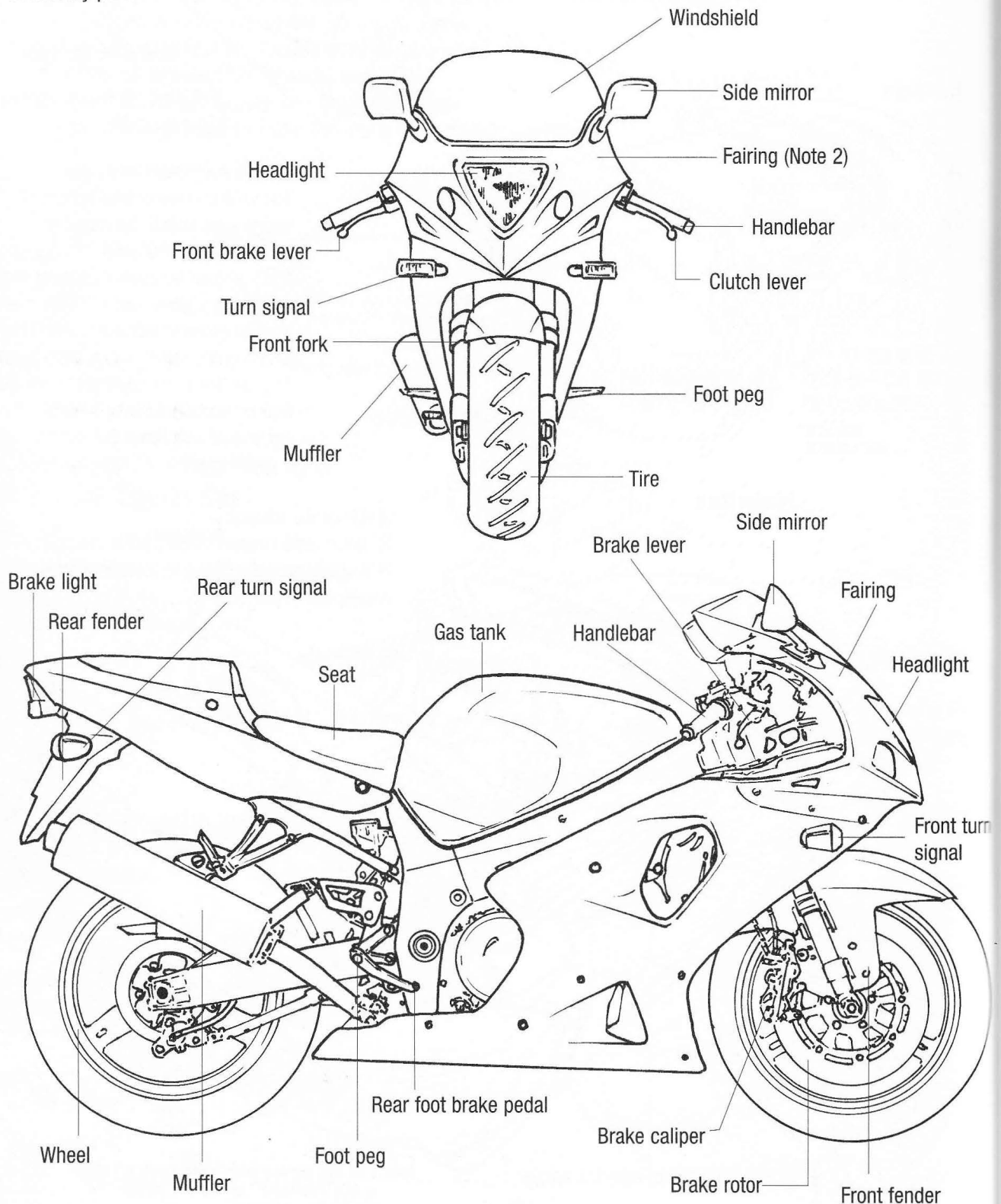
Stick shift (Allows the driver to shift gears when changing speeds)



## Pleasing Forms: Motorcycles (Racer Replica)

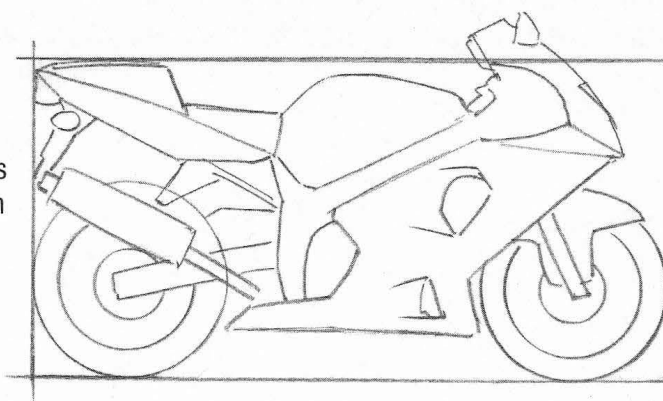
### Know the Minimum Parts Necessary

Unlike the car, which is covered with an exterior, the working parts of a motorcycle are exposed. Before drawing a motorcycle, make sure you are familiar with the minimum necessary parts.



## Devise the Composition

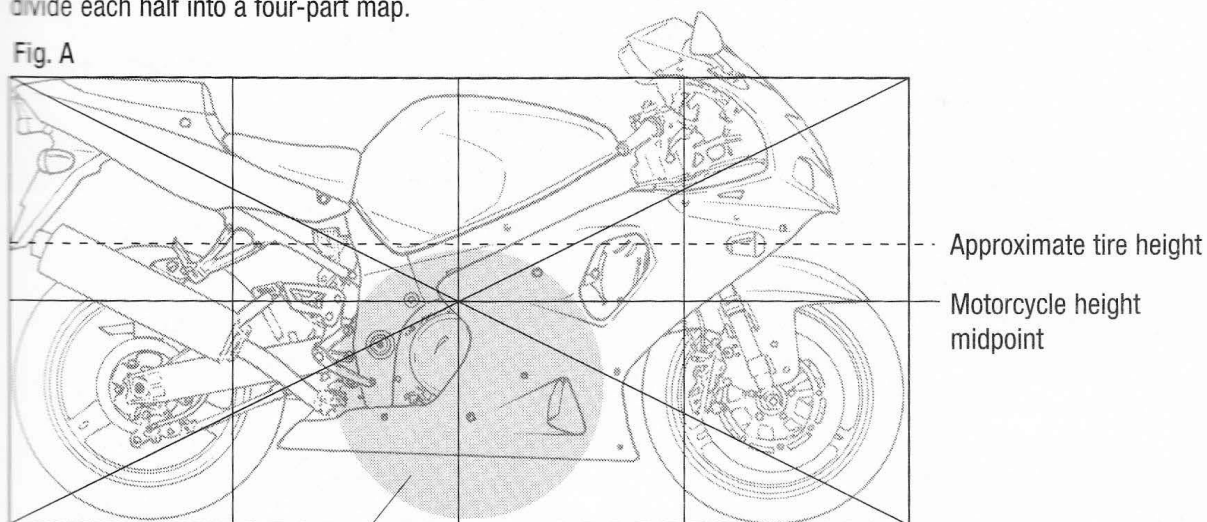
Thinking of a motorcycle in terms of squares will help you establish the composition.



**But, before that...**

Find the center of the composition, and then divide each half into a four-part map.

Fig. A

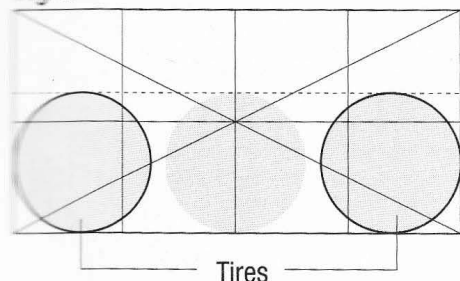


This section is about one tire in size.

Motorcycle length midpoint

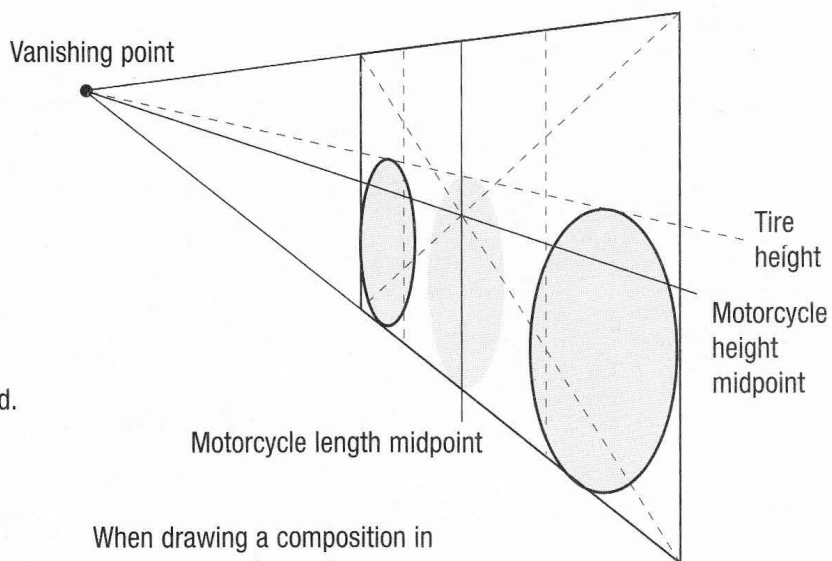
Determining what parts fall in which section will help you when it comes time to lay out the composition. The center point of the motorcycle's length lies around the gas tank, while that of the motorcycle's height lies somewhere below the gas tank. Further, the full length is just longer than three tires.

Fig. B



This illustrates how the tires are positioned.

See the appendix (p. 126) for information on how to divide the composition into quarters.

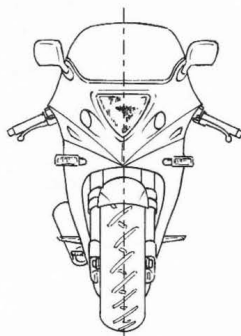
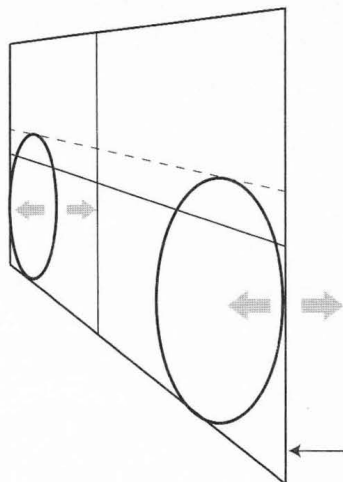


When drawing a composition in perspective, refer to figures A and B and establish the tires' positioning. Once you have done this, the rest should be a snap.

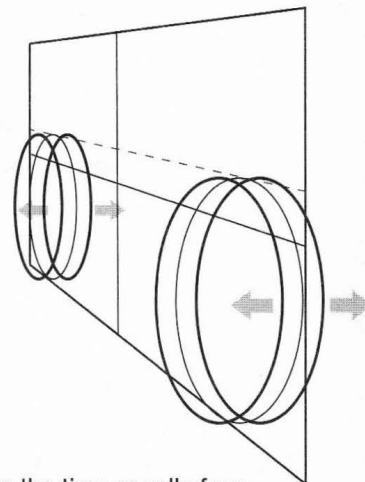


## Giving a Motorcycle Volume

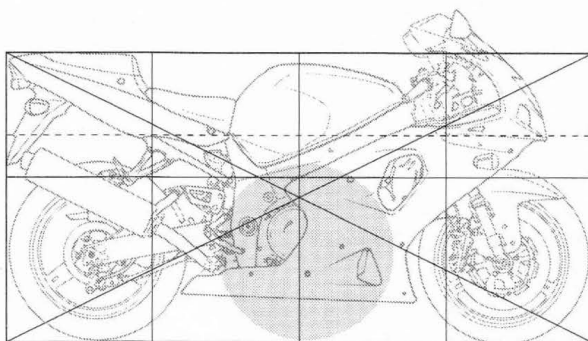
You can easily give the motorcycle proper volume by building up the left and right sides equally.



Picture this as the motorcycle's center.

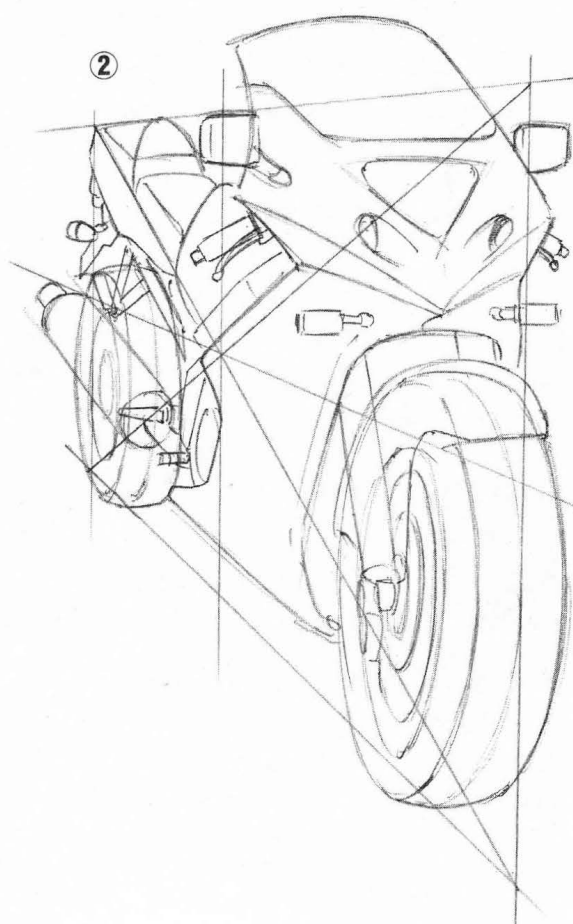
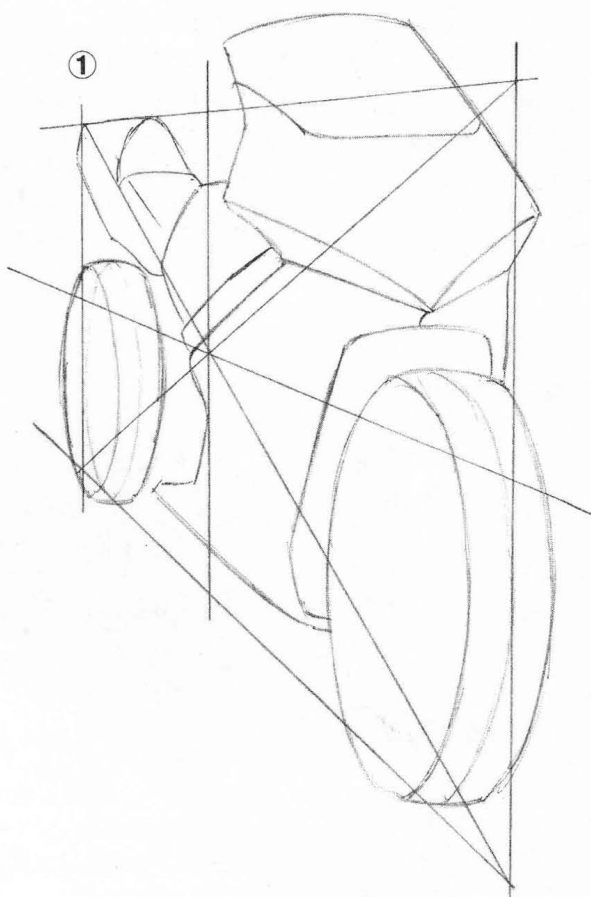


Build up the tires equally from side to side to give them volume.



① Using the map on the figure to the left as a point of reference, create a rough sketch of the motorcycle.

② Next, add any parts needed to make the motorcycle more convincing.



3 Add in the supplementary parts.

Use the air intake at the base of the engine to draw the gentle curve of the fairing. Be precise when drawing the disc brake of the front wheel and the radiator.

#### Windshield

The contrast between white, illustrating reflected light, and a dark gradation tone generates a sense of sheen.

#### Intake

Drawing the intakes allows you to portray the curved surfaces.

4 Motorcycles tend to have an abundance of glossy parts, so use solid blacks to suggest reflections.

Radiator

Spot blacks for the mechanical parts visible from underneath the fairing. This will help them to look convincing. The solid blacks create a contrast with light areas, pulling together the composition.

Fender

Muffler

Ground reflection

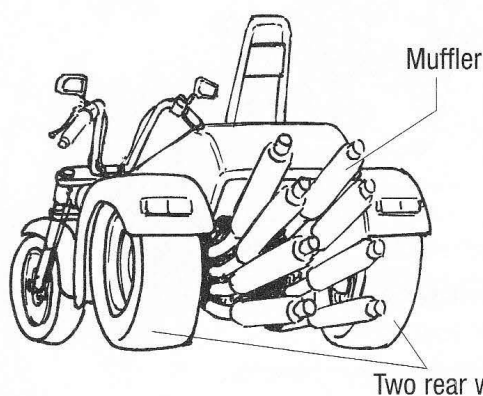
Narrow strip of gradation

Adding solid black for the ground reflection to the muffler's lower portion and then a narrow strip of gradation tone to the lit area produces a chrome-like texture.

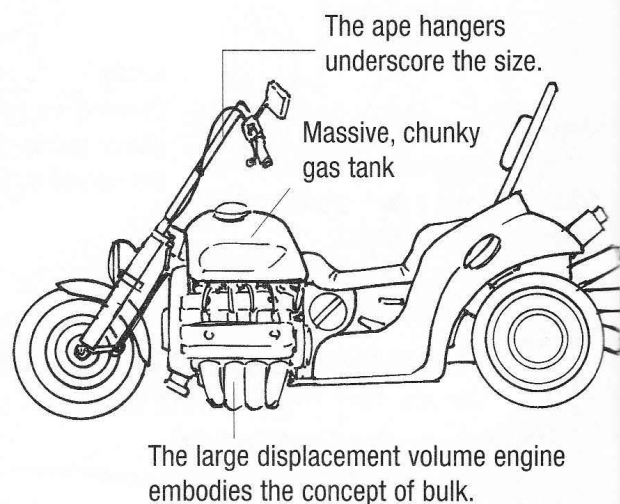
The glossy finish is suggested by the reflections of the surroundings and the use of gradation tone.

## Overall Form with a Sense of Weight: Trikes

Simply equipping your motorcycle with an ultra-huge engine or a profusion of mufflers will make your bike look heavy. However, drawing your motorcycle with two wheels in back and turning it into a trike will give it even more weightiness.



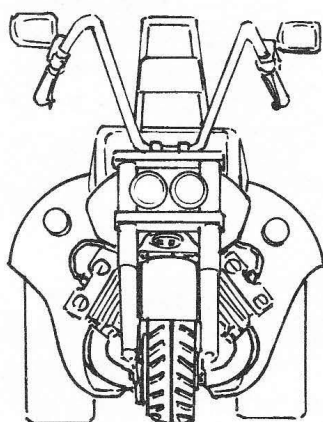
Two rear wheels



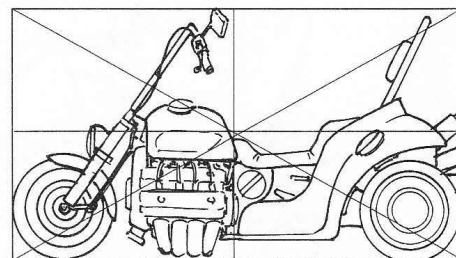
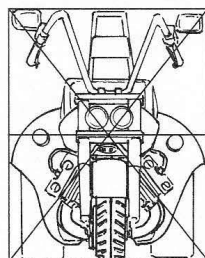
The ape hangers underscore the size.

Massive, chunky gas tank

The large displacement volume engine embodies the concept of bulk.



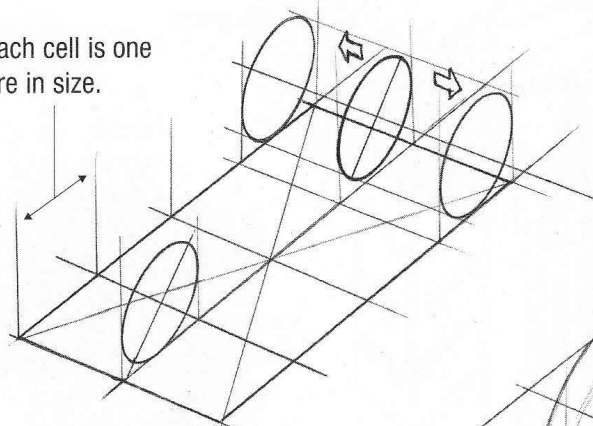
First, lay out the map and check which parts go where.



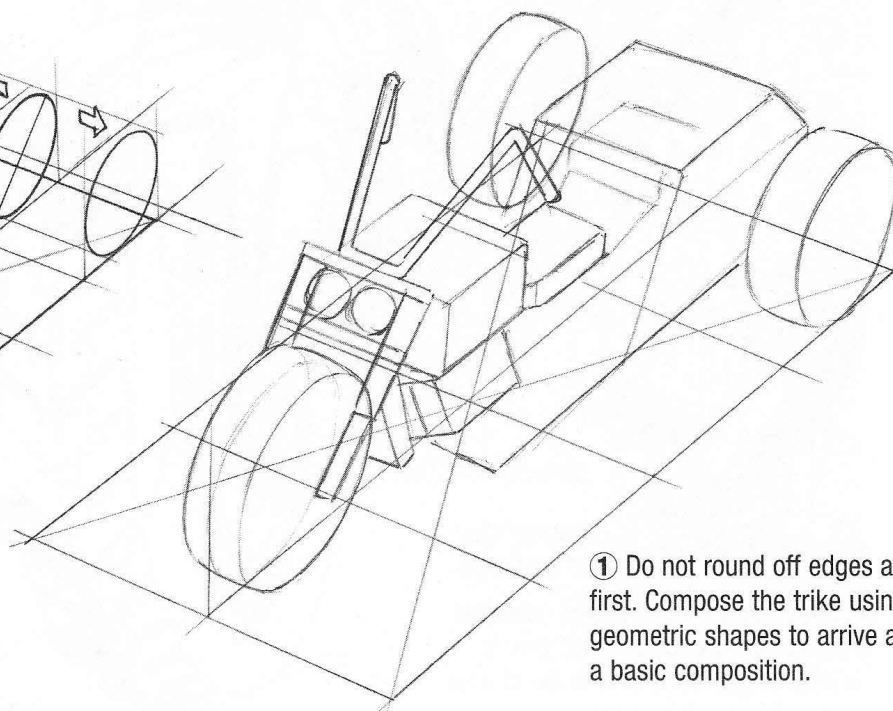
The center point is toward the gas tank's rear. The entire trike is four tires in length.

### Drawing a Trike

Each cell is one tire in size.

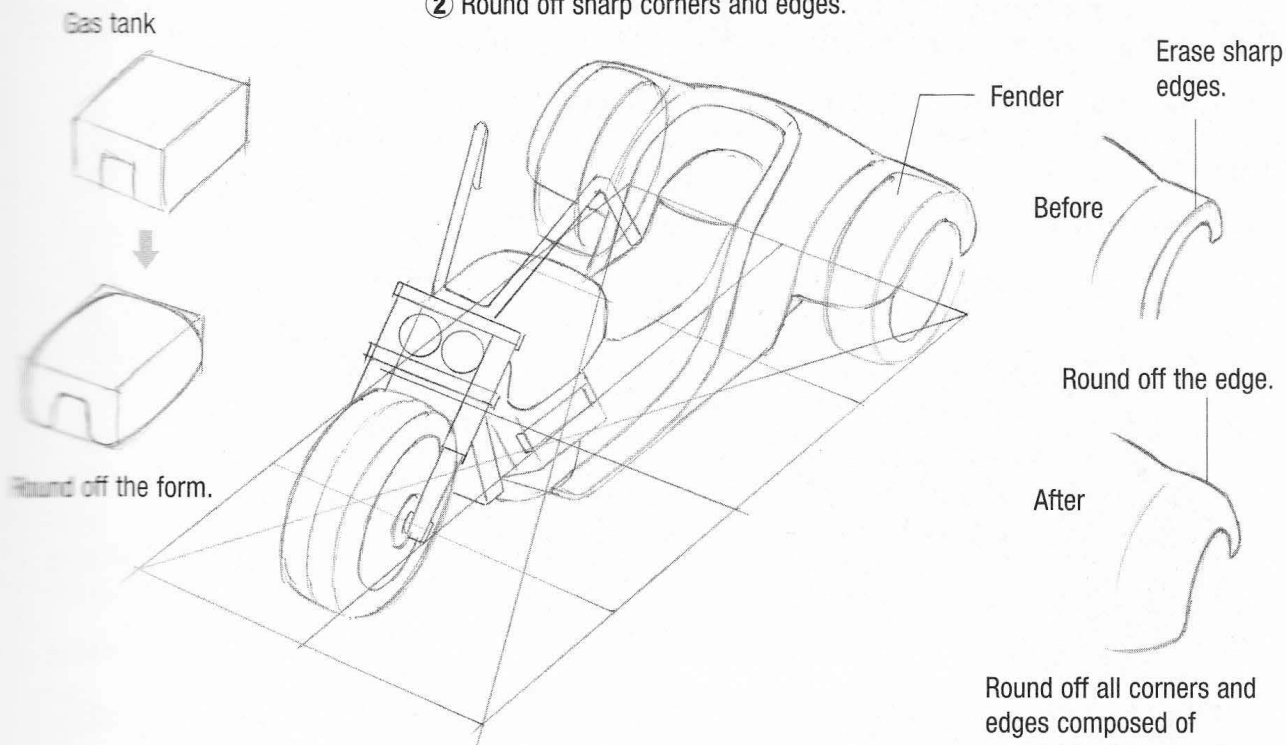


Just like with the car, draw a rectangle on the ground. Divide it into four equal parts and position the tires.

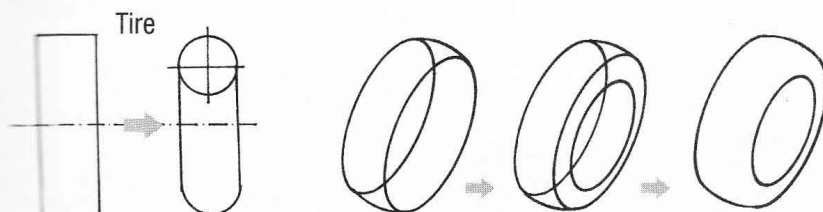


① Do not round off edges at first. Compose the trike using geometric shapes to arrive at a basic composition.

② Round off sharp corners and edges.

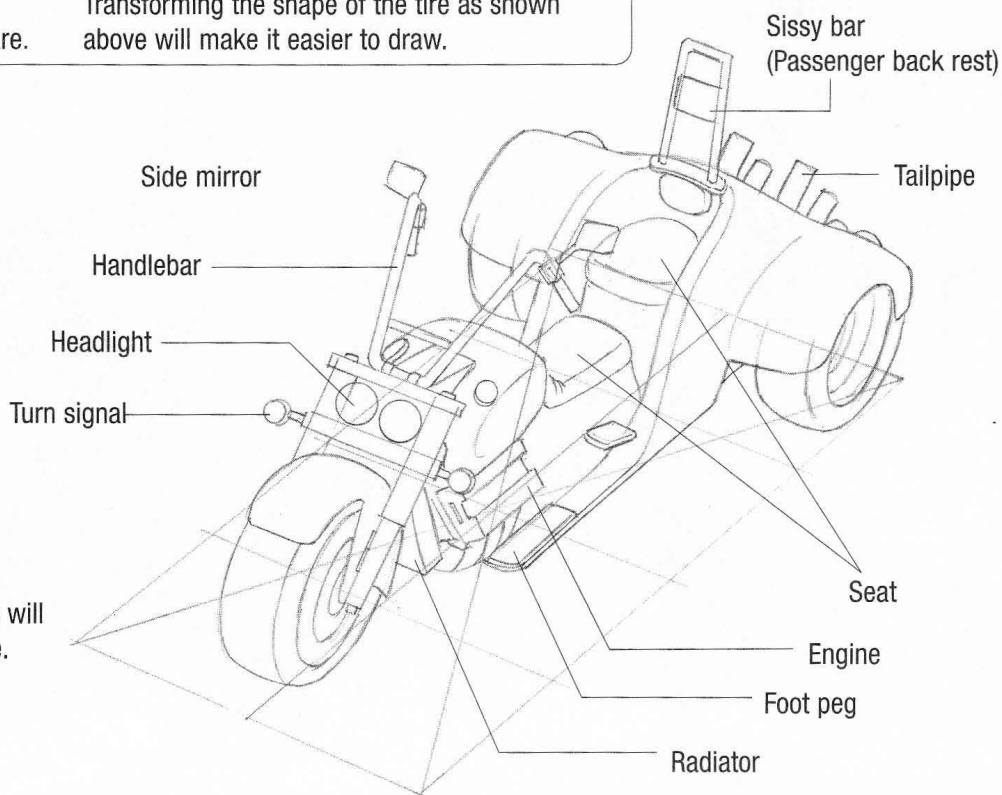


**Drawing a Tire**



A tire is closer to a circle than to a square.

Transforming the shape of the tire as shown above will make it easier to draw.



③ Adding the sissy bar, mufflers, turn signals, and other supplementary parts will beef up your monster trike.



④ Add in details, such as in the engine and radiator, tire tread, etc. Taking care with drawing seat wrinkles and other textures will enhance the sense of realism.

## Engine Close-up

Sparkplugs and wires

Cylinder head  
(Valve cover)

Exhaust pipe

Engine block

Wrinkles

Engine

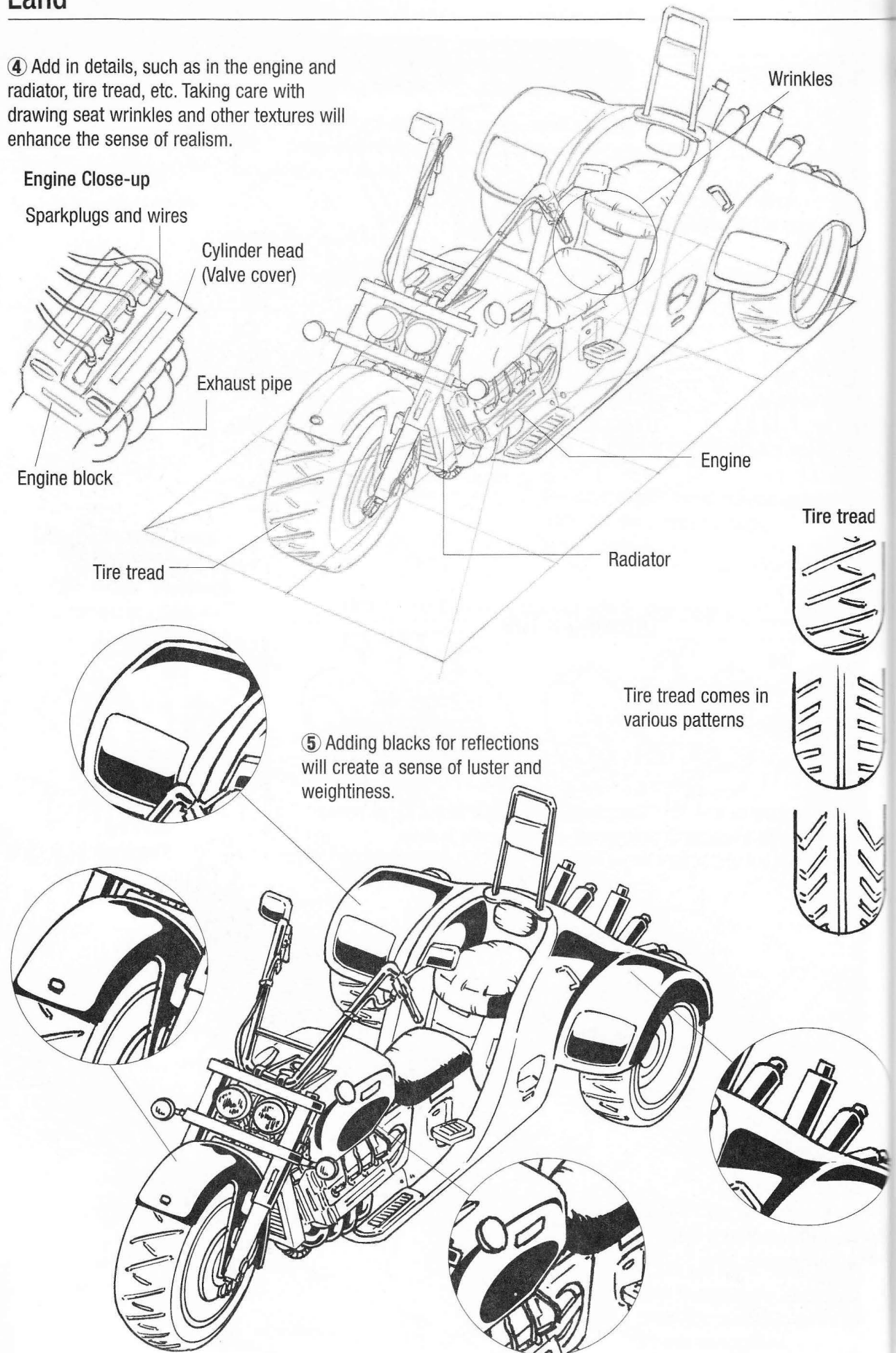
Radiator

Tire tread

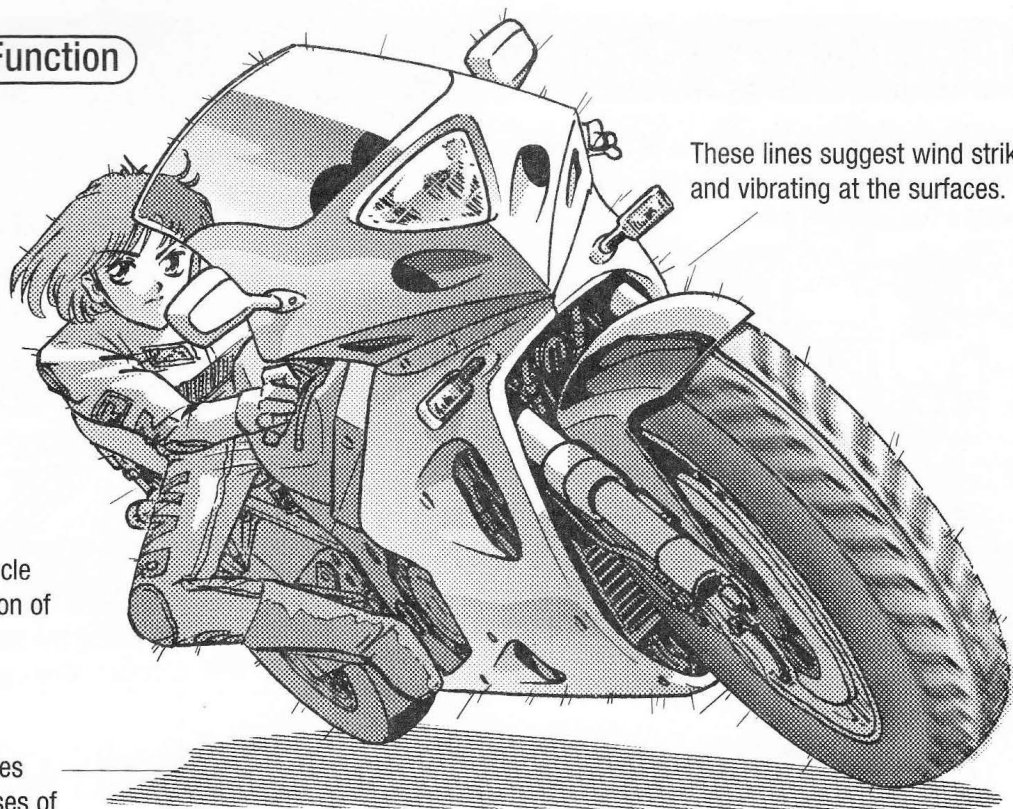
Tire tread

Tire tread comes in various patterns

⑤ Adding blacks for reflections will create a sense of luster and weightiness.



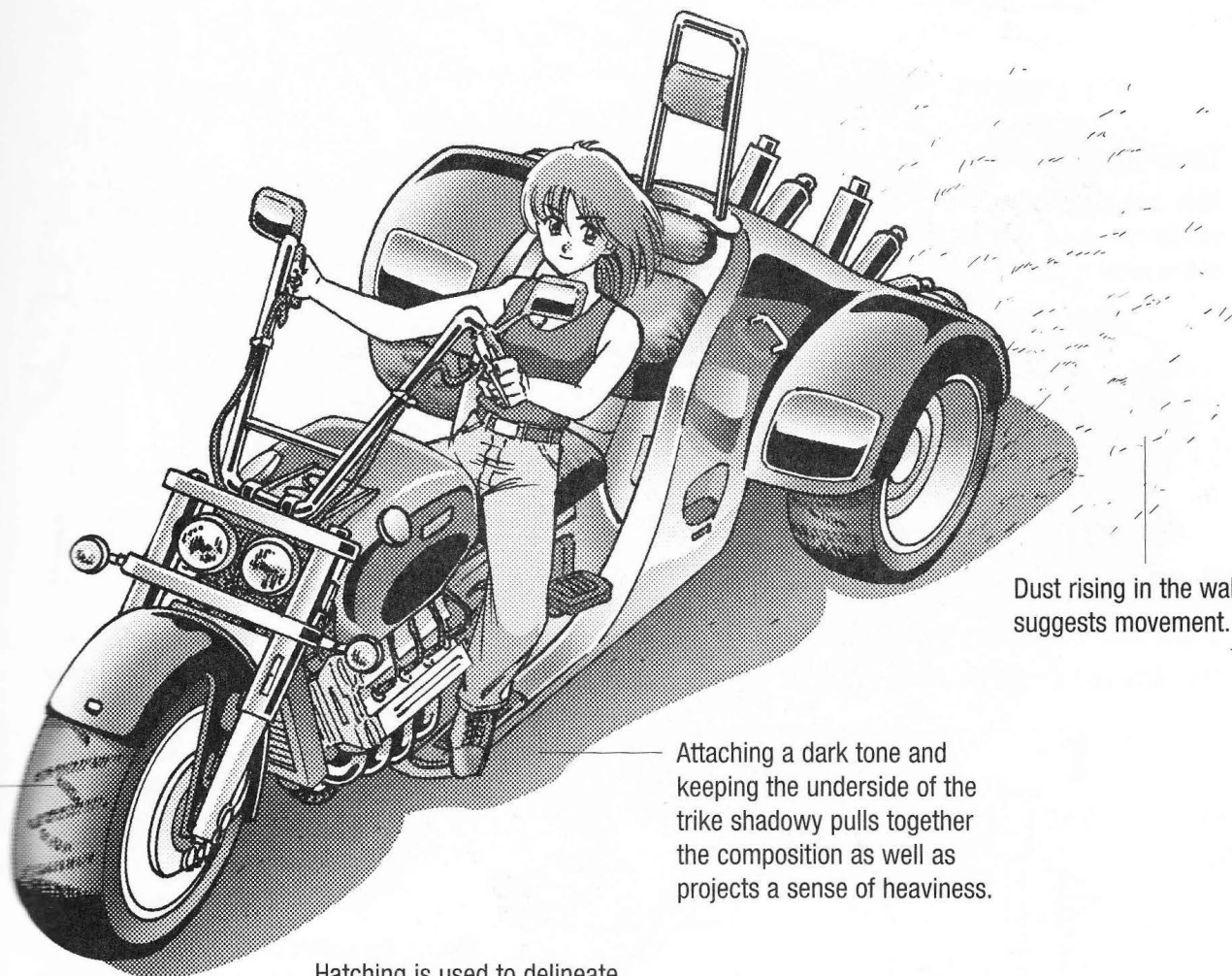
## Emphasizing Function



These lines suggest wind striking and vibrating at the surfaces.

Tilting the motorcycle gives the impression of deft handling.

Adding shadow lines heightens the senses of speed and agility.



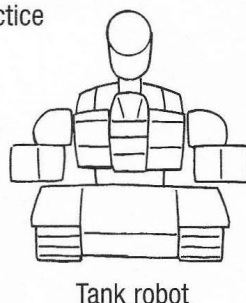
Dust rising in the wake suggests movement.

Attaching a dark tone and keeping the underside of the trike shadowy pulls together the composition as well as projects a sense of heaviness.

Hatching is used to delineate tire tread and to suggest a rolling motion.

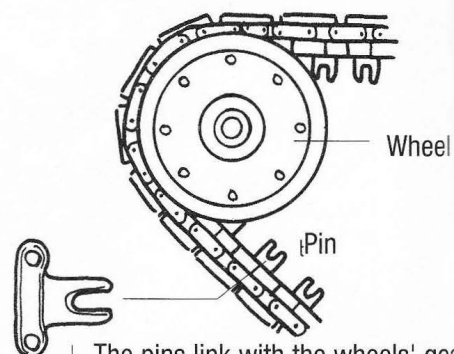
## Depicting Bulky Machines Moving: Robot (Caterpillar Tracks)

Caterpillar tracks are a special type of tread used on tanks and bulldozers. Here, we will practice drawing a hulking tank robot.



Tank robot

Caterpillar Track Close-up



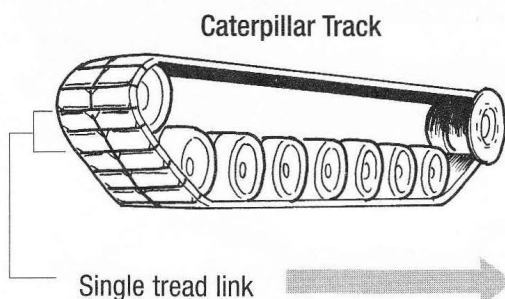
Wheel

Pin

The pins link with the wheels' gear causing the caterpillar track to rotate, allowing movement.

### Structure of a Caterpillar Track

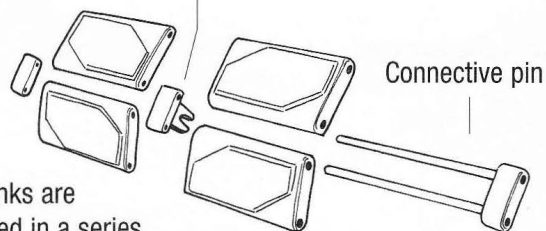
Caterpillar tracks differ from tires in that they comprise multiple steel links.



Caterpillar Track

Single tread link

Enlargement

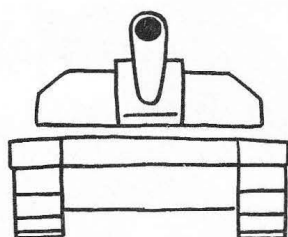


Connective pin

These links are connected in a series, forming the track.

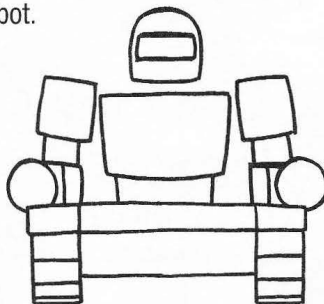
### Tank/Robot Combo

With caterpillar tracks, even a heavy, massive vehicle can move over rough terrain. Fusing this with a robot results in an undefeatable tank robot.

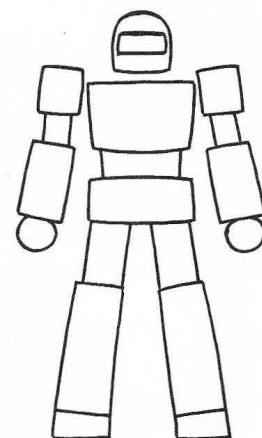


Remove the tank's gun turret.

### Tank/Robot Fusion!

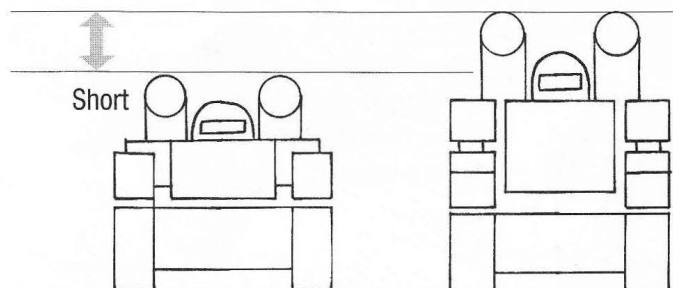


Replace the turret with a robot's upper body.



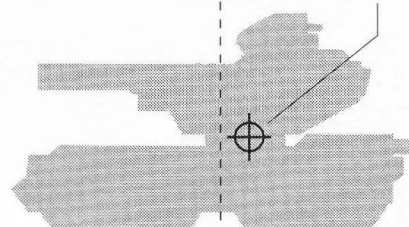
### Show Consideration toward Stability

The wider and shorter the robot, the better its stability.



Short

Center line Center of gravity

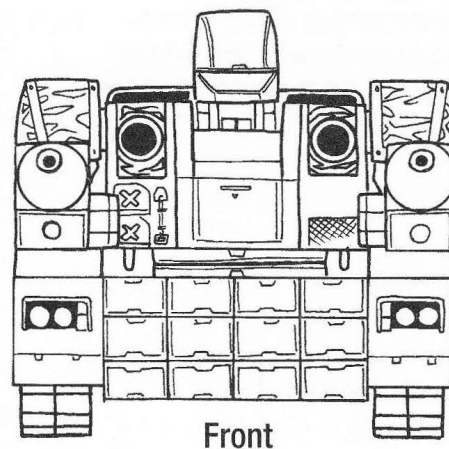
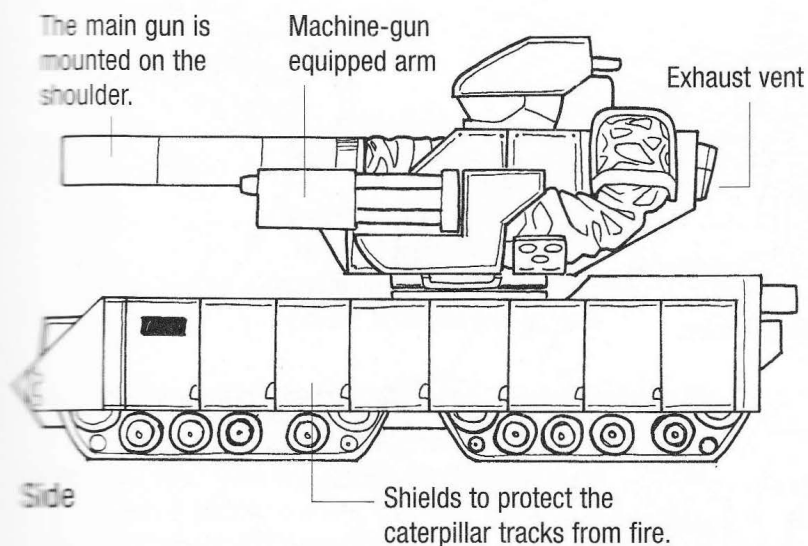


Shifting the center of gravity behind the center line will make your tank robot appear balanced.

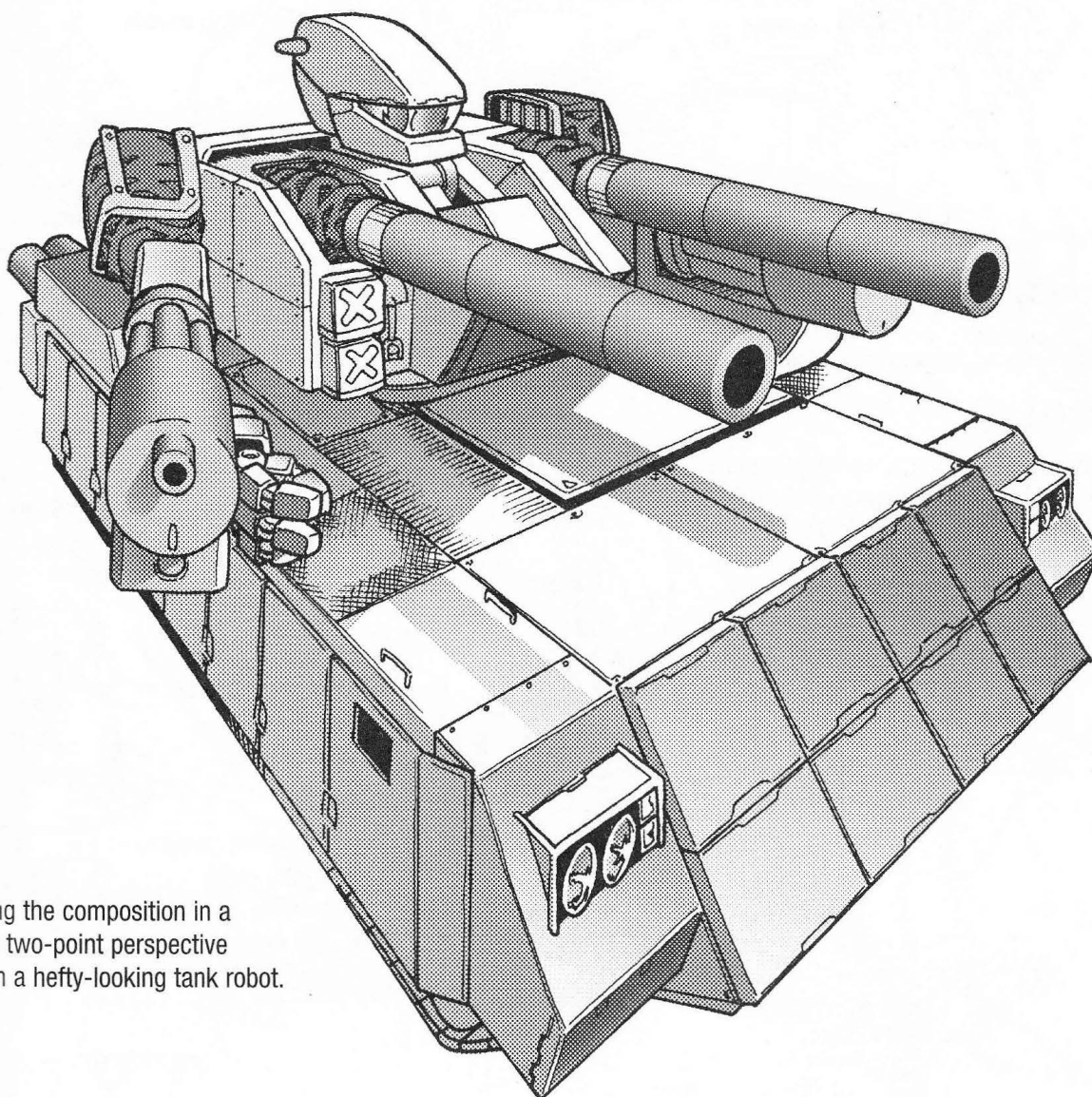


## Boosting Armament

Now that we have improved our tank robot's sense of balance, we can equip it with more substantial weapons of destruction.



Adding assorted artillery results in a bulkier overall form.

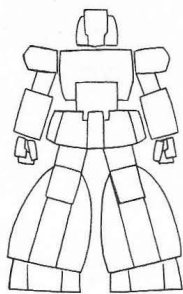


Rendering the composition in a dynamic two-point perspective results in a hefty-looking tank robot.

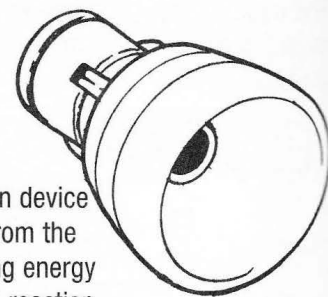


## Depicting Agile-moving Mecha: Robots with Booster Rockets

Equipping your robot's legs with booster rockets will enhance its mobility and speed. Now let's try creating a robot capable of gliding nimbly over the ground.



Skate Model Robot

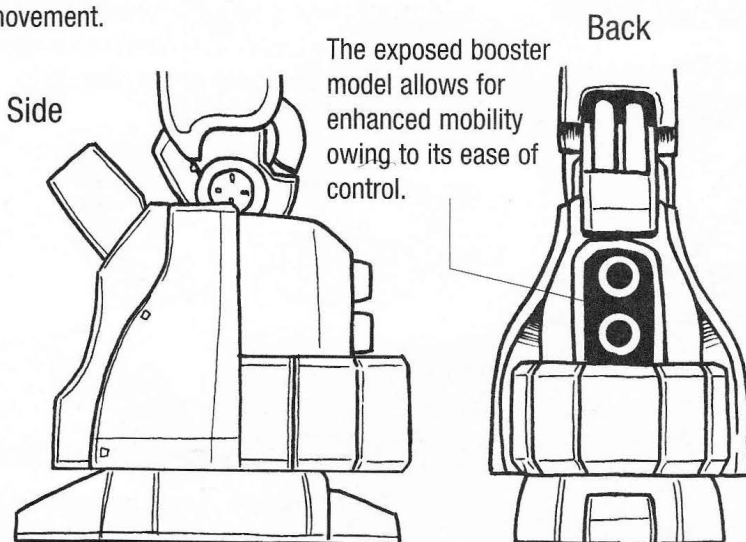


### Booster Rocket

This is a jet propulsion device that gains its thrust from the explosion of expanding energy created in a chemical reaction.

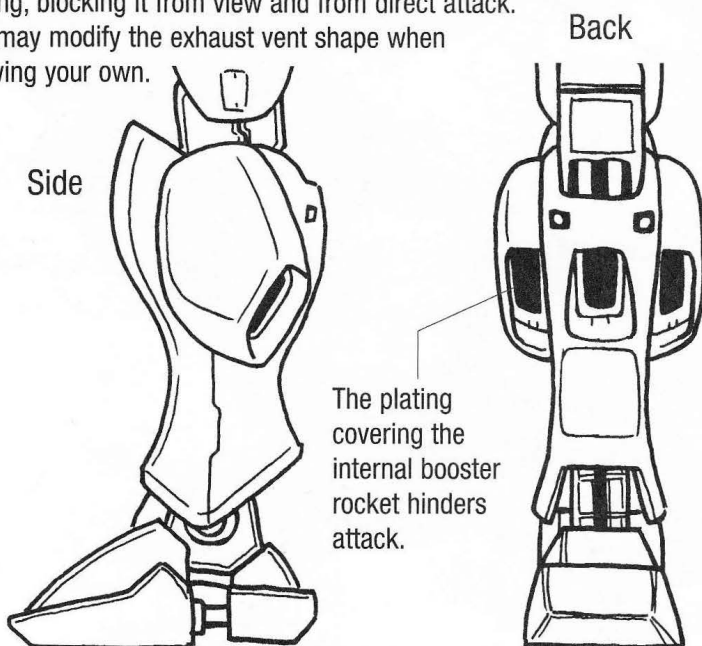
### Exposed Model

Here, the booster rocket is visible. Adjusting the direction of the nozzles allows for precise movement.



### Internal Model

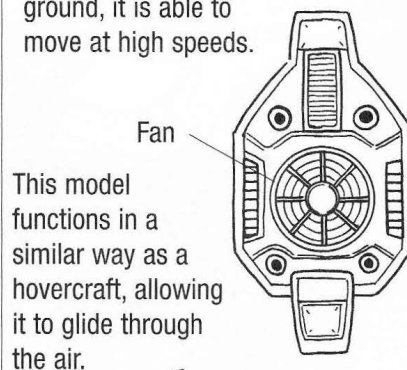
Here, the booster rocket is covered by protective plating, blocking it from view and from direct attack. You may modify the exhaust vent shape when drawing your own.



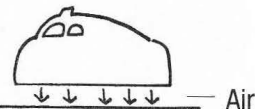
### Assorted Foot Designs

#### Hover Model

In this model, the robot uses air pressure to hover over the ground. Since this model encounters no friction with the ground, it is able to move at high speeds.

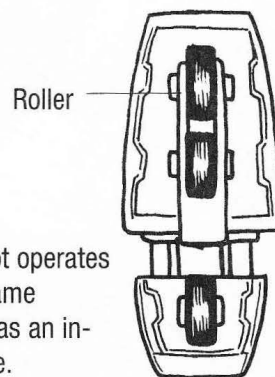


This model functions in a similar way as a hovercraft, allowing it to glide through the air.



#### Roller Model

This model is unable to glide through the air. However, the lack of need for fans means reduced weight.



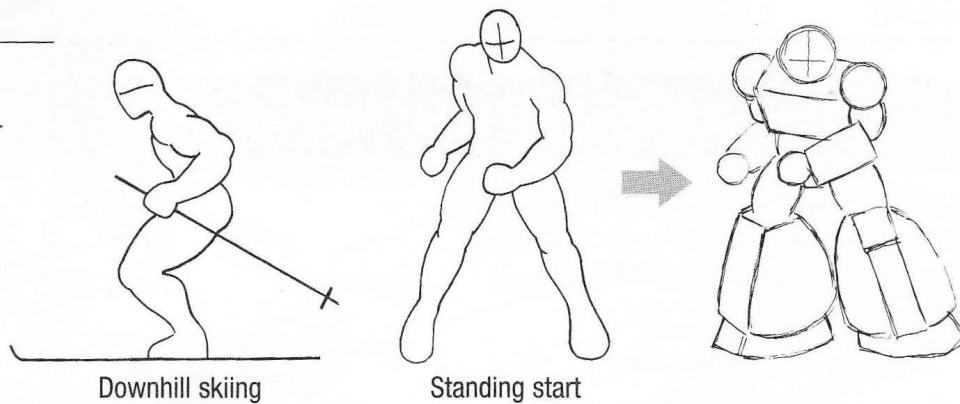
This robot operates on the same premise as an in-line skate.



### On Poses

These robots do not move their legs back and forth, but rather maintain a fixed pose.

Consequently, their pose could be likened to that of a downhill skier or to a racer's standing start pose.

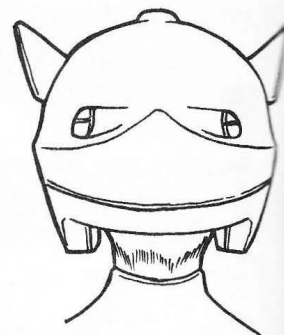


## Practice: Drawing a Female Android

Let's practice equipping a female android with ground mobility devices. We will use booster rockets and draw her in a gliding pose.



Reference image



### • Aero-helmet

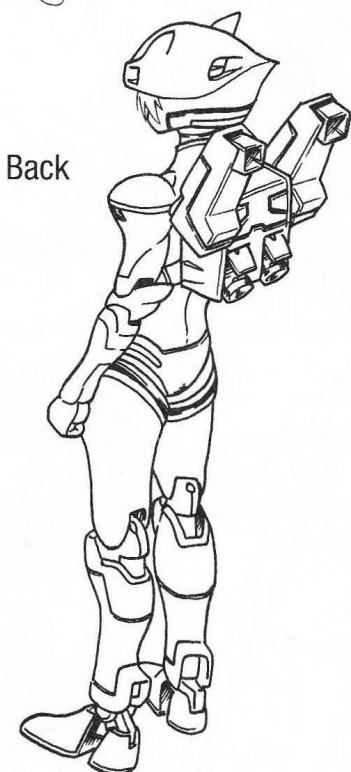
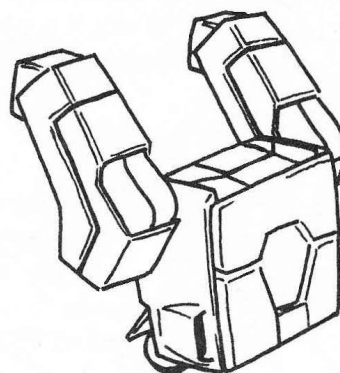
This protects the head in falls. The form is full of air-resistance minimizing, rounded curves.



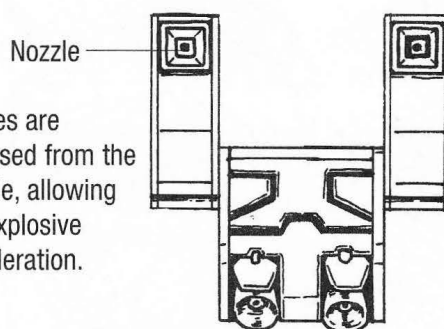
Front

### • Backpack

Worn on the back, this is a box-shaped propulsion device containing an internal booster rocket.



Back



Nozzle

Fumes are released from the nozzle, allowing for explosive acceleration.

Back view

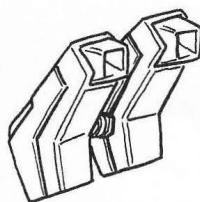
The backpack should be easy to draw if you picture an old-fashioned, leather school backpack.



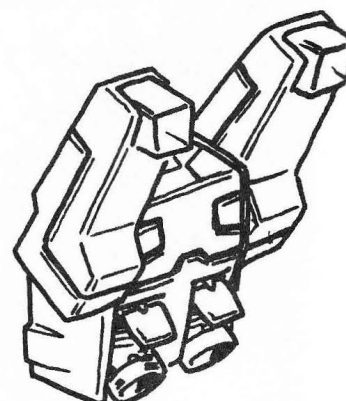
School backpack  
(Used for the main unit)



Nozzle

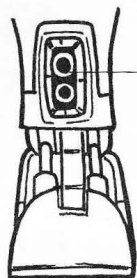


Arms (Contain  
auxiliary boosters)



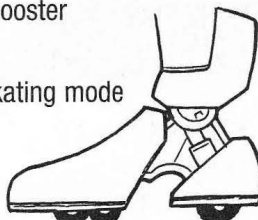
Completed backpack

Note: The aero-helmet is akin to cycling helmets worn by professional riders.

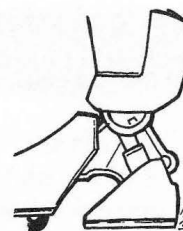


Auxiliary booster

Normal skating mode



Rollers

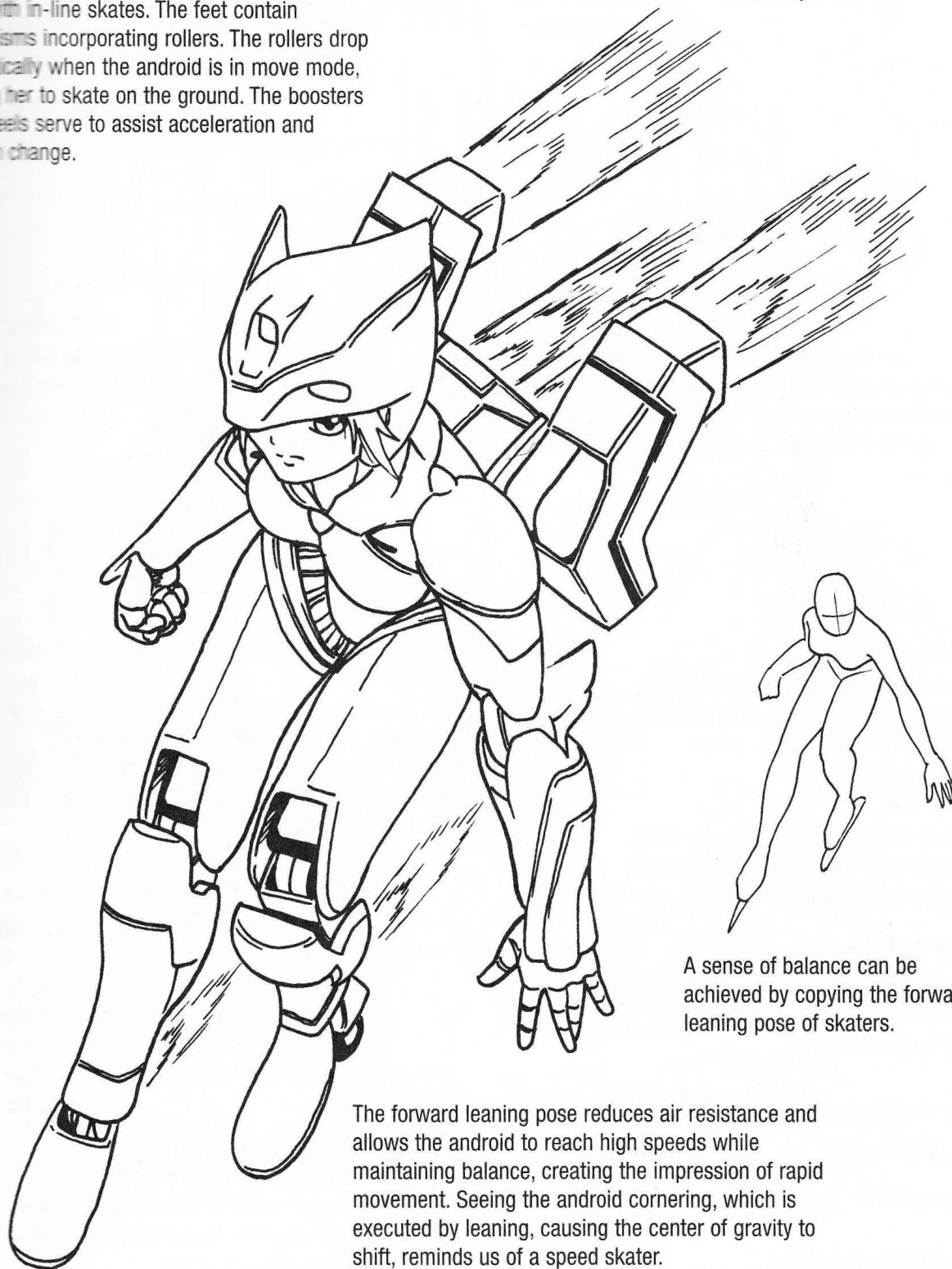


Breaking

The heel is dropped, using contact with the ground to reduce speed.

## In-line Heels

Created "in-line heels" by merging high-heeled shoes with in-line skates. The feet contain mechanisms incorporating rollers. The rollers drop automatically when the android is in move mode, allowing her to skate on the ground. The boosters on the heels serve to assist acceleration and direction change.



A sense of balance can be achieved by copying the forward leaning pose of skaters.

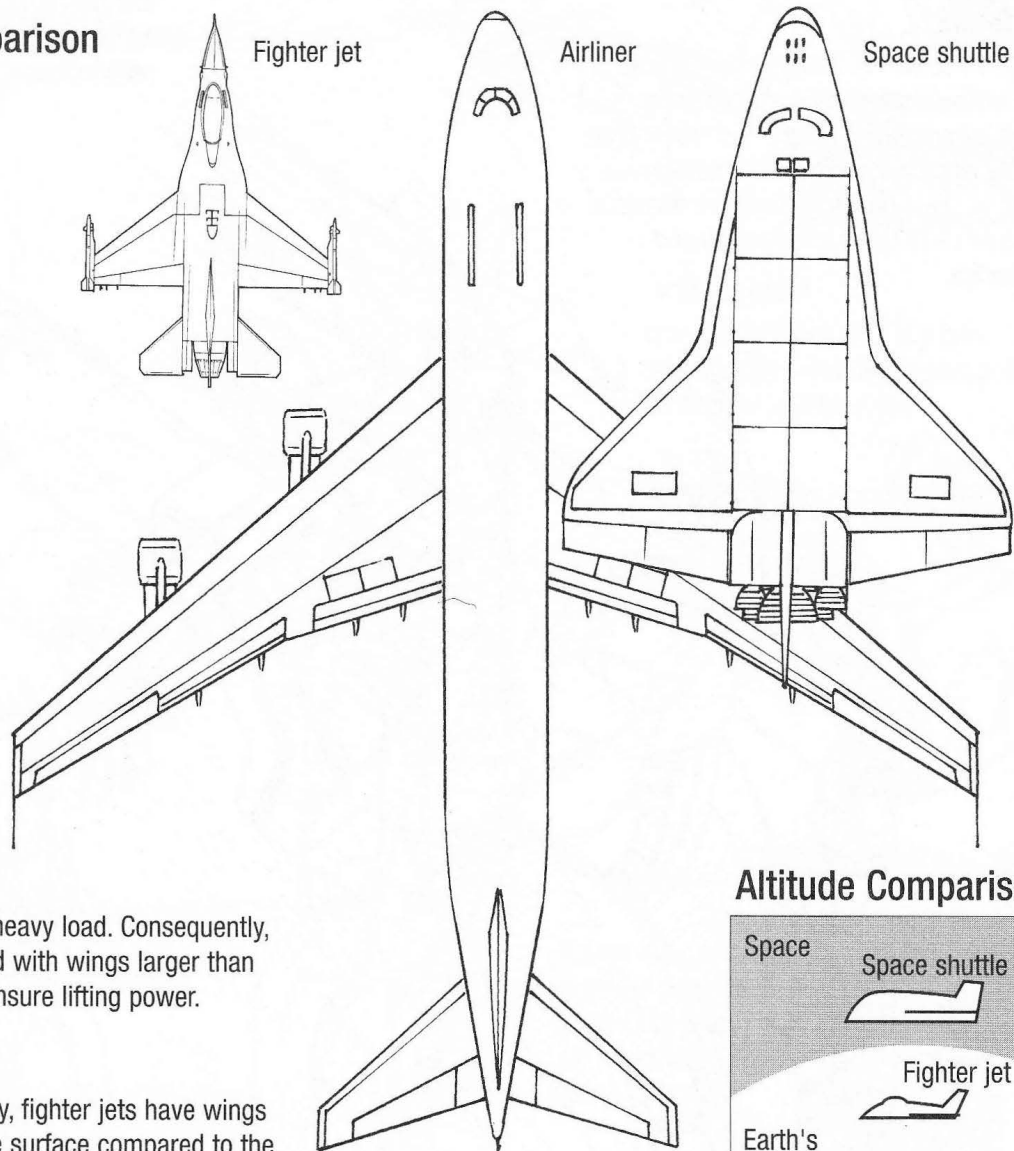
The forward leaning pose reduces air resistance and allows the android to reach high speeds while maintaining balance, creating the impression of rapid movement. Seeing the android cornering, which is executed by leaning, causing the center of gravity to shift, reminds us of a speed skater.



## Shapes That Enable Flight

Aircraft come in a variety of shapes, depending on the speed or altitude at which they are to fly, etc. Furthermore, they must have wings to enable flight.

### Size Comparison



#### Airliner

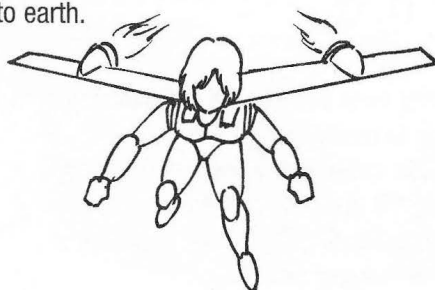
Airliners carry a heavy load. Consequently, they are designed with wings larger than the fuselage to ensure lifting power.

#### Fighter Jet

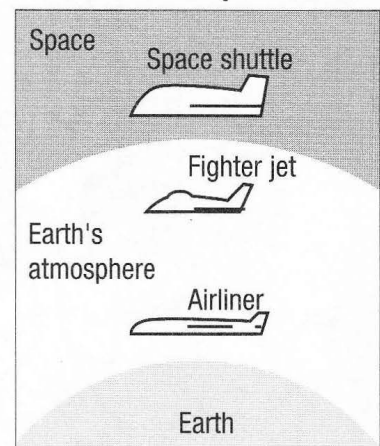
To ensure mobility, fighter jets have wings with considerable surface compared to the fuselage and high-powered engines.

#### Space Shuttle

While not necessary in space, the space shuttle possesses large wings, designed for use in its return to earth.



### Altitude Comparison



### Key Point Wings are necessary to flight

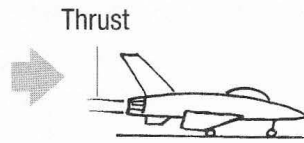
Airplanes cannot obtain lift without wings, and wings are essential to generating lifting power. Any flying mecha that you design will need wings.

# How Flight Works

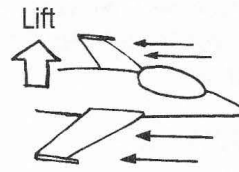
Flight refers to the generation of thrust, which is then converted to lifting power, allowing the aircraft to lift into the air and move forward.



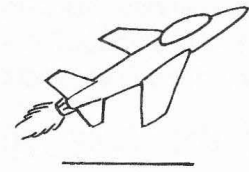
Thermal energy is created by an explosion inside the engine and then is released.



Thrust is gained, pushing the plane forward.



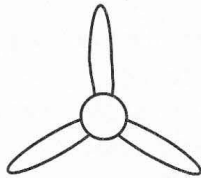
Air hits the wing, generating lift.



The aircraft then flies.

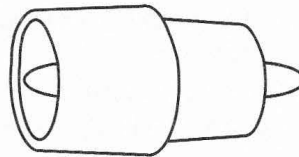
## Propulsion Devices

For the creation of lift, thrust must first be generated.



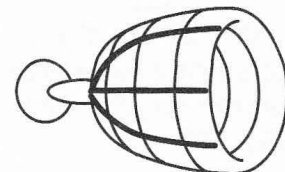
**Propeller**

The rotating propeller creates wind, generating thrust.



**Jet Engine**

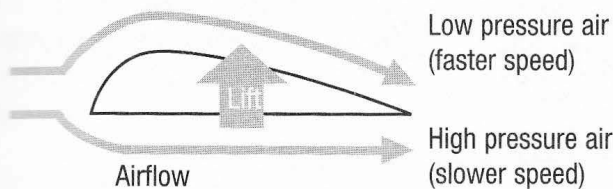
The jet engine is an advanced version of the propeller. A series of actions take place, whereby air is sucked in from the front, ignited, and then allowed to escape out the back.



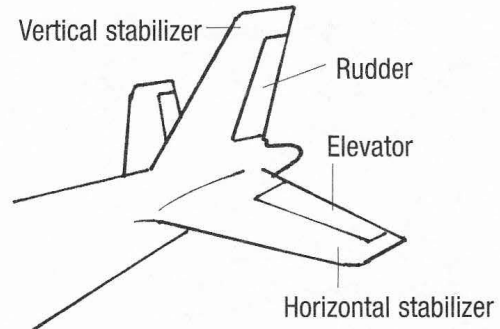
**Rocket Engine**

Here, a reaction is caused with solid or liquid fuel, causing it to burn. This then gushes out through a rocket nozzle, generating thrust.

## How Lift Is Created



When the wind generated by thrust flows over and under the wing, it moves at different speeds, causing a change in air pressure. The wings are pulled (lifted\*) in the direction of low air pressure, allowing them to rise.



## How Planes Fly

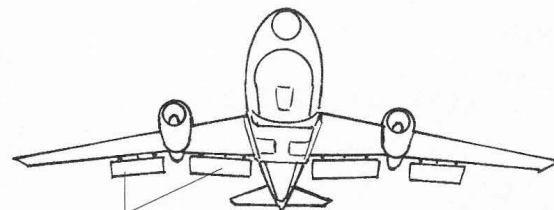
For the creation of lift, thrust must first be generated.

### • Changing Direction (The Rudder)

The pilot changes directions by adjusting the angle of the rudder, which is attached to the vertical stabilizer.

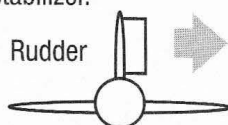
### • Ascending and Descending (The Elevators)

The pilot causes the plane to climb or descend by adjusting the angle of the elevators, which are attached to the horizontal stabilizer.

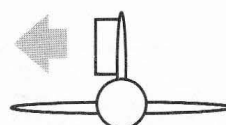


**Flaps**

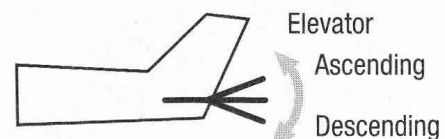
Flaps increase lift and are used when taking off and landing.



Moving to the right



Moving to the left



**Elevator**

Ascending

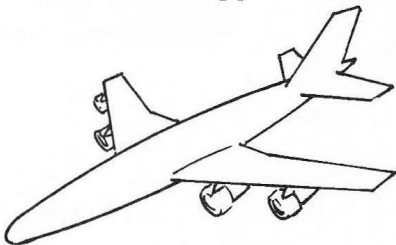
Descending

**Note:** The wing is pulled in the direction of low air pressure. The readers have likely watched a movie scene where a window of an airplane in flight breaks, causing unattached objects to be sucked out of the plane. This occurs, because the air pressure outside the plane is lower than that inside. Visualizing it in this way may help you understand this phenomenon, which is the same as that occurring above the plane's wing.

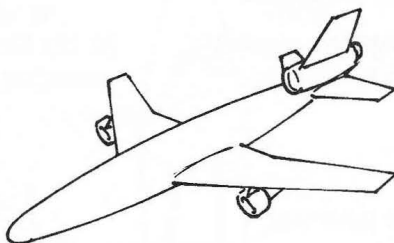
## Passenger Planes: Airliners

Since airliners must carry a large number of passengers and considerable luggage, they are the slower of the aircraft discussed earlier. Yet, they are the most familiar to us. Airliners can be divided into three general categories.

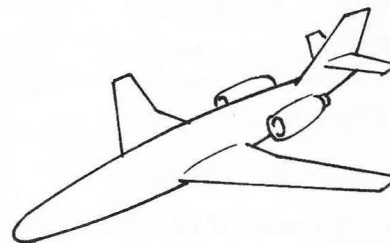
### ● The Three Types of Airliners



**Engine underneath the wings**  
(Designed to carry a large number of passengers over long distances)  
Seats 400 to 600

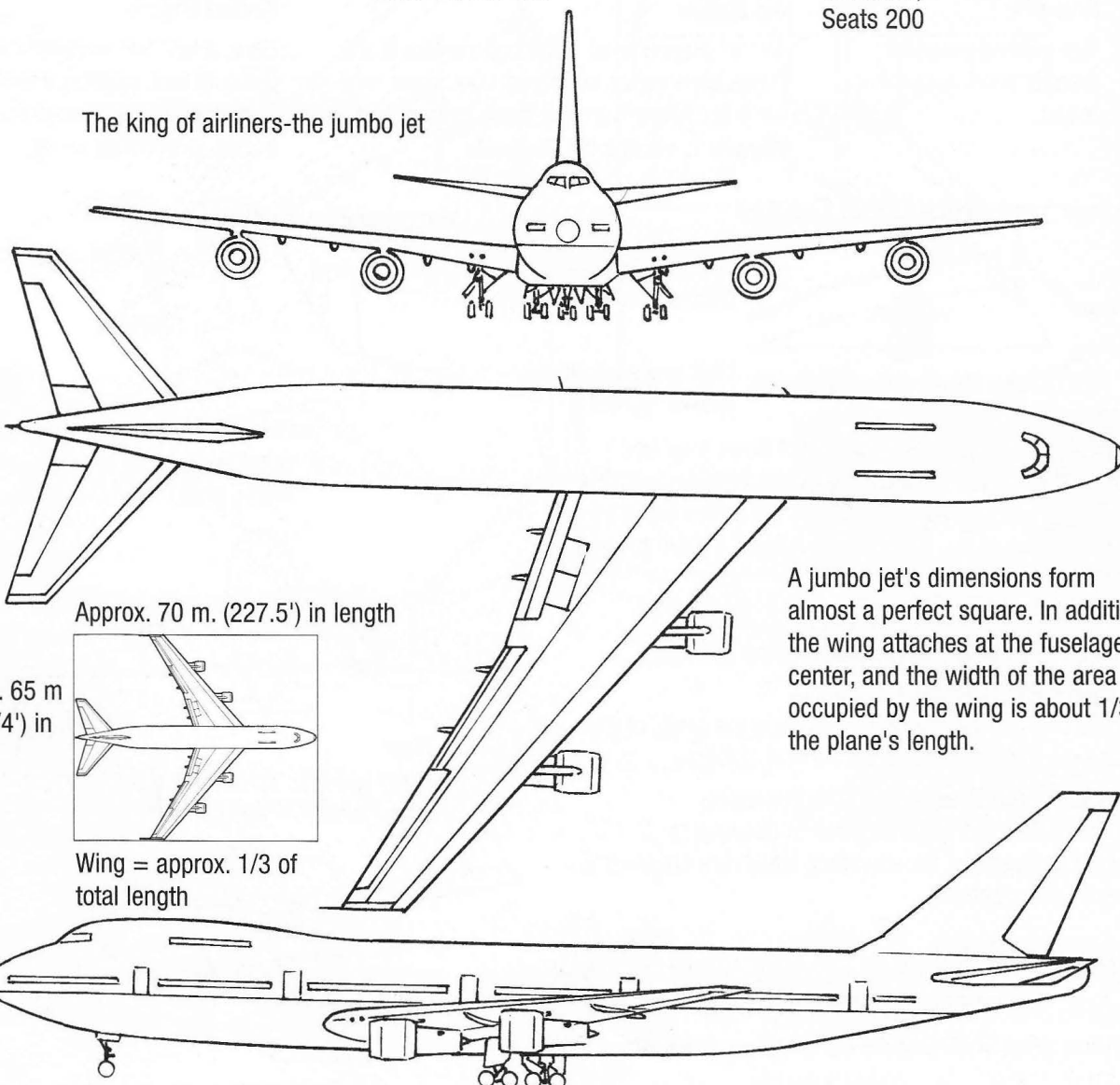


**Engine underneath the wings and attached to the tail**  
(Designed to carry a medium number of passengers over mid-range distances)  
Seats 200 to 400



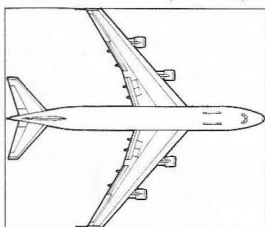
**Engine attached to the sides of the fuselage**  
(Designed to carry a small number of passengers over short distances)  
Seats 200

The king of airliners-the jumbo jet



Approx. 70 m. (227.5') in length

Approx. 65 m  
(211 1/4') in  
width

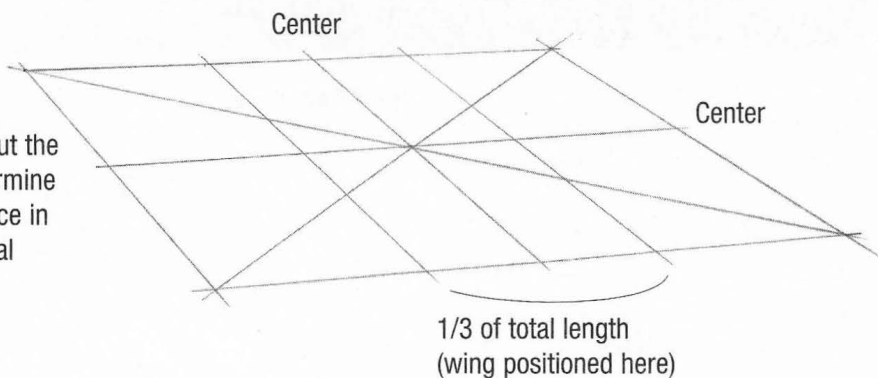


Wing = approx. 1/3 of  
total length

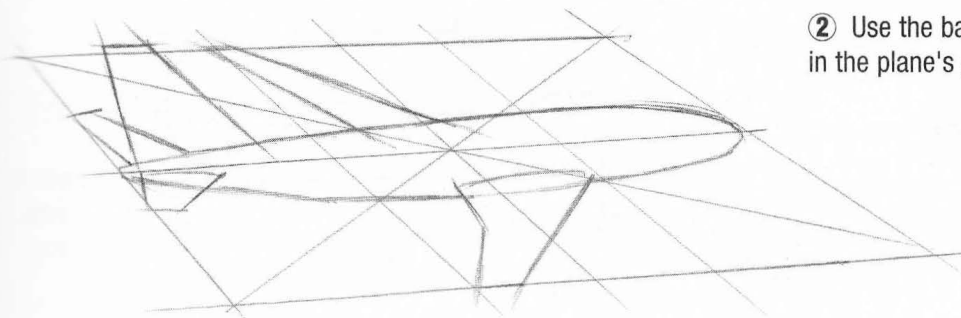
A jumbo jet's dimensions form almost a perfect square. In addition, the wing attaches at the fuselage's center, and the width of the area occupied by the wing is about 1/3 of the plane's length.

## Drawing a Jumbo Jet

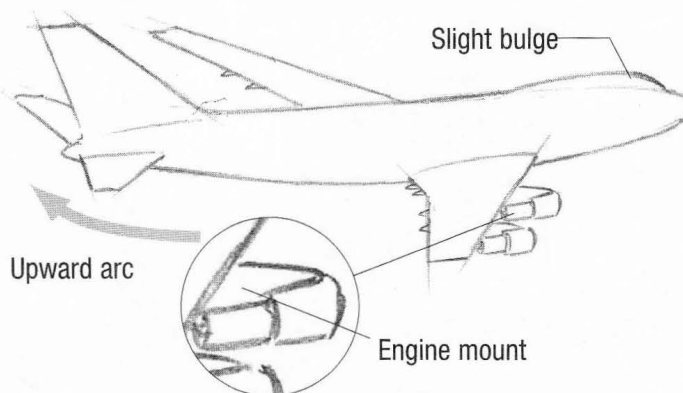
① Draw a box, in which you will lay out the jumbo jet. Draw diagonal lines to determine the center. In addition, block out a space in the center about 1/3 of the plane's total length. This will be for the wings.



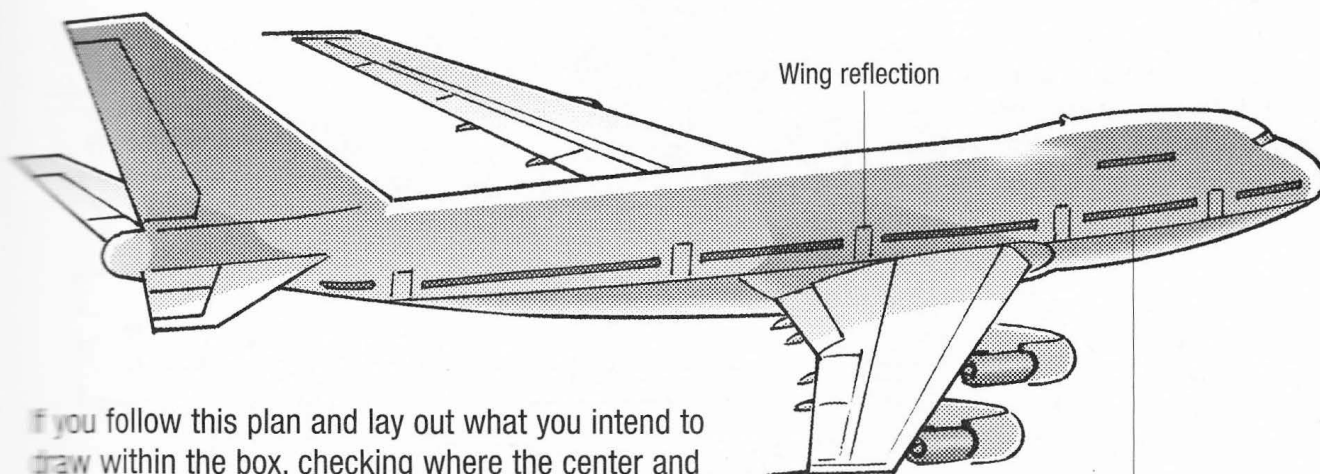
② Use the base map as a guide, sketching in the plane's general shape.



③ Drawing the airplane's neck with a bulge will make it look more like a jumbo jet. The back of the fuselage does not touch the ground during takeoff, so draw it arcing upward. The jet engine is attached under the wing by means of a mount. Note that the engine is not attached directly to the wing.



④ Draw the main wings and tail. Add in the windows to finish.



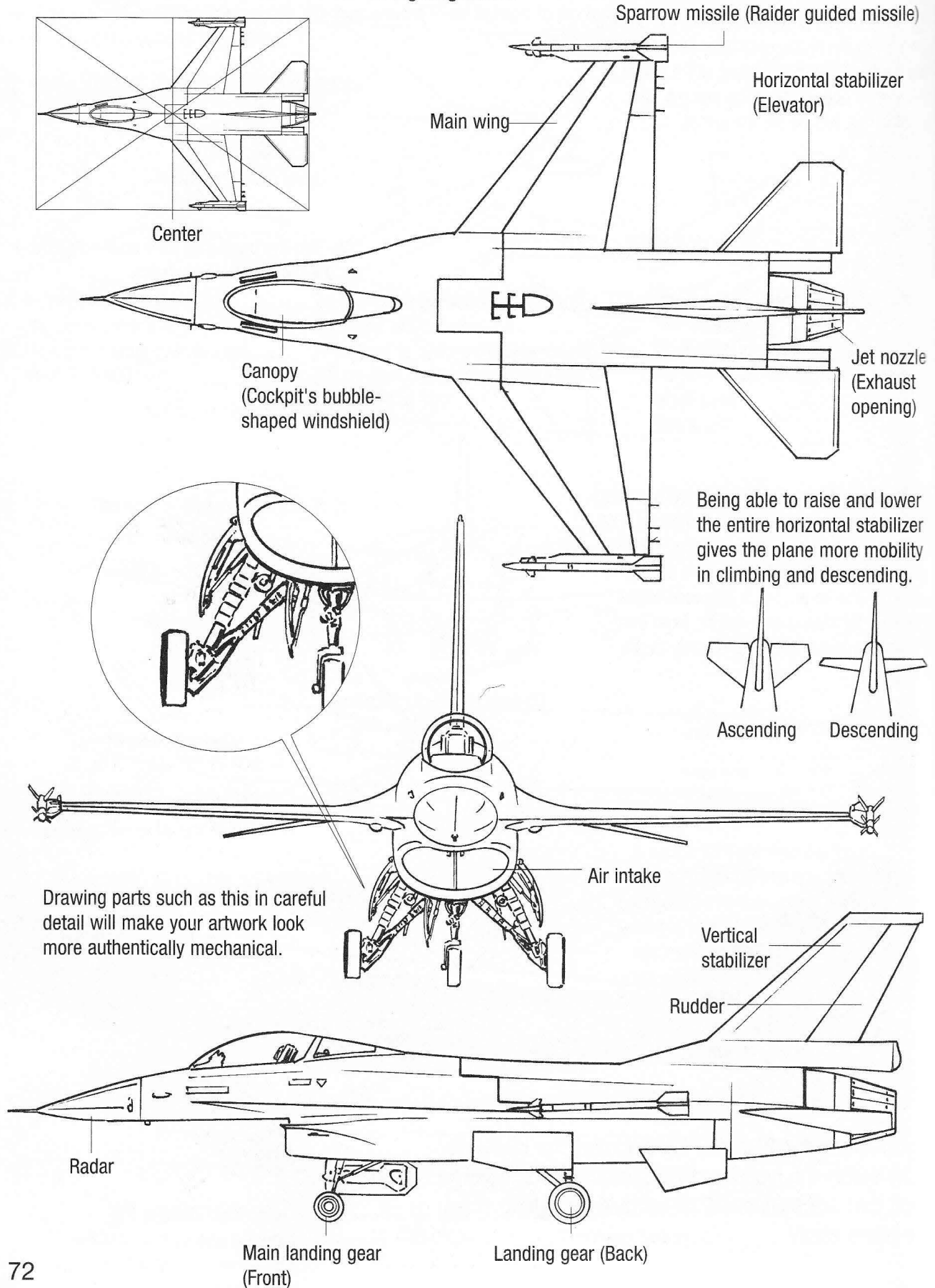
If you follow this plan and lay out what you intend to draw within the box, checking where the center and each part are positioned, you should be able to draw the plane easily.

Rather than drawing the windows one by one, another alternative is to draw them as solid strips.



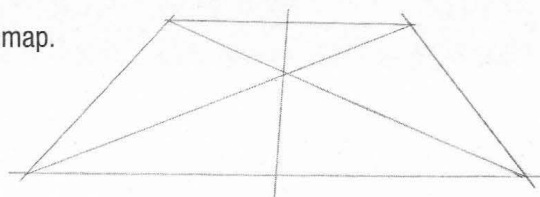
# Airplanes Designed for Mobility: Fighter Jets

YF-16 Fighting Falcon

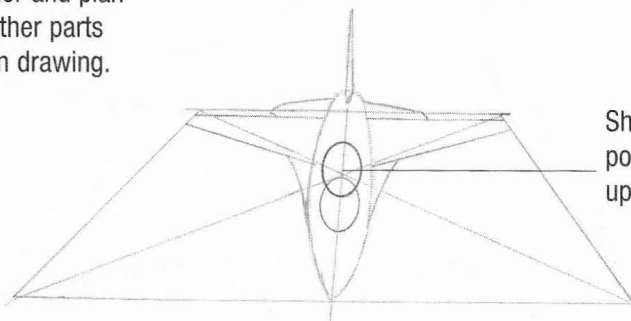
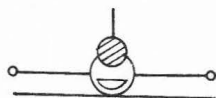


## Drawing a Fighter Jet

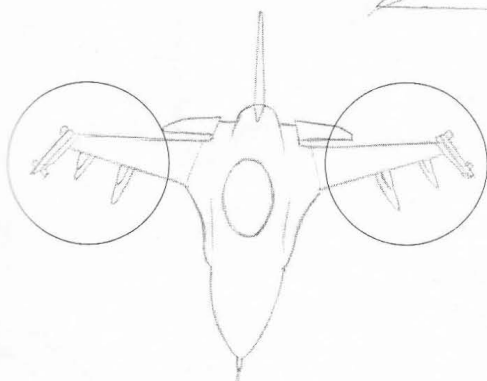
① First, lay out the base map.



② Think of the base map as being like the ground (see fig. below). Consider and plan the height of the canopy and other parts located above the ground when drawing.



Shift only the elevated portion of the canopy upward on the map.

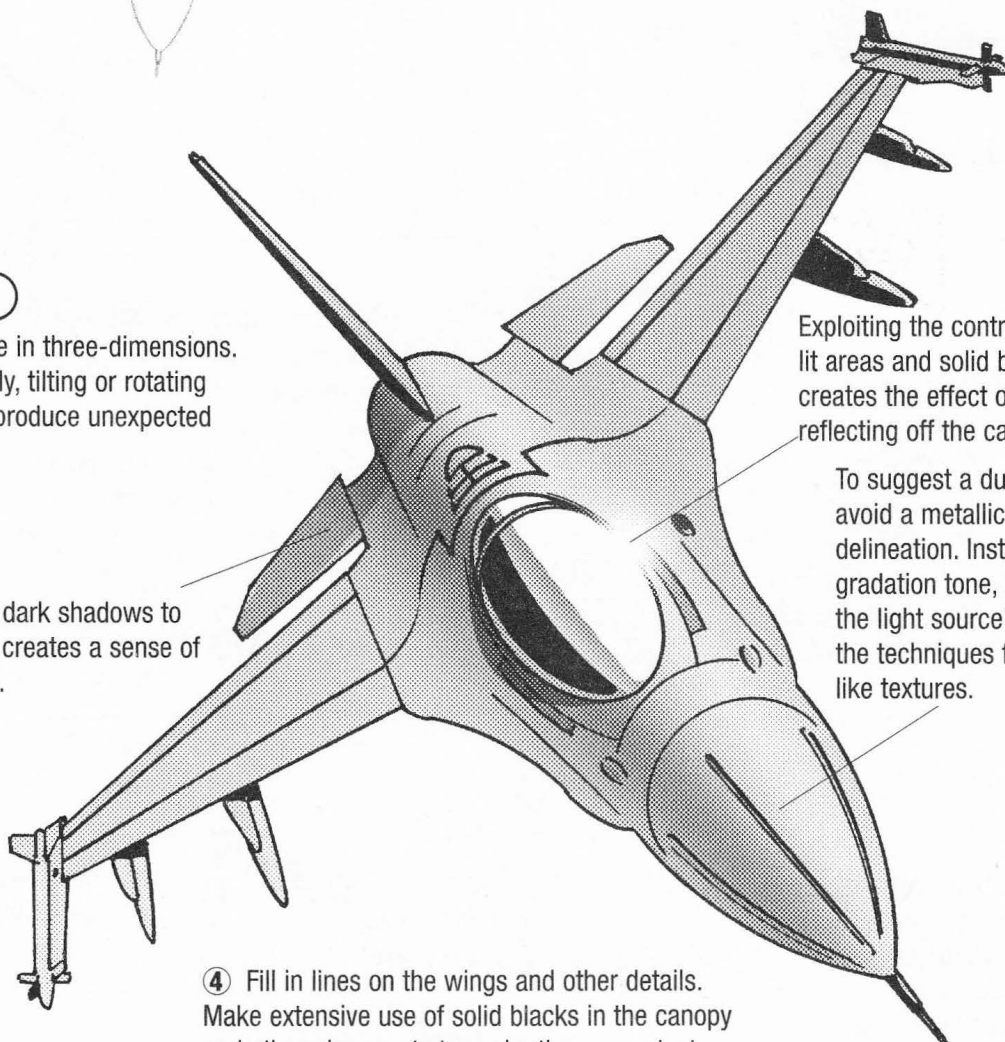


③ Clean up the drawing according to your intended form design. At this time, add in missiles underneath and at the tips of the wings as well as any other necessary parts.

### Tip

Planes move in three-dimensions. Consequently, tilting or rotating the jet can produce unexpected effects.

Adding dark shadows to the tail creates a sense of volume.

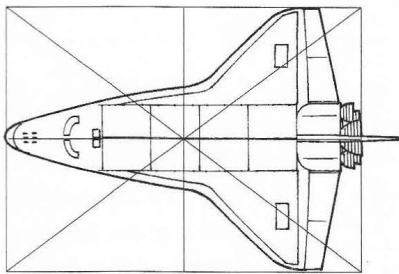


Exploiting the contrast between lit areas and solid blacks creates the effect of light reflecting off the canopy.

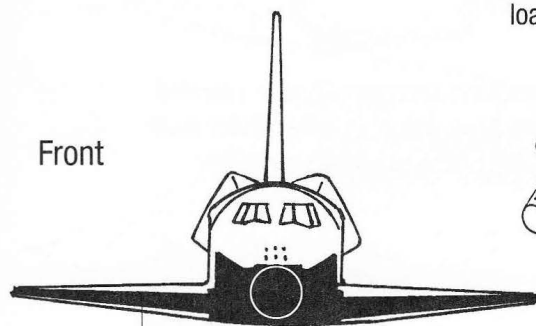
To suggest a dull, matte surface, avoid a metallic-like clean delineation. Instead, attach gradation tone, having it lighten in the light source's direction. Apply the techniques for creating rubber-like textures.

④ Fill in lines on the wings and other details. Make extensive use of solid blacks in the canopy and other glass parts to evoke the proper texture. Finishing with screen tone results in a realistic final image.

## Aircraft Capable of Space Flight: Space Shuttles

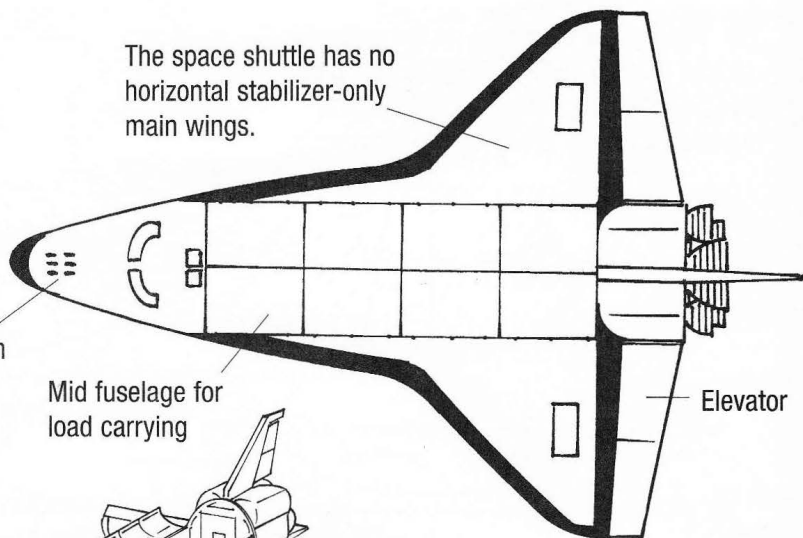


Forward RCS module with vernier jets (Forward Reaction Control System)



Front

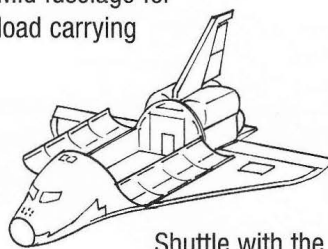
Ceramic coating was used to withstand the heat of reentry into the atmosphere.



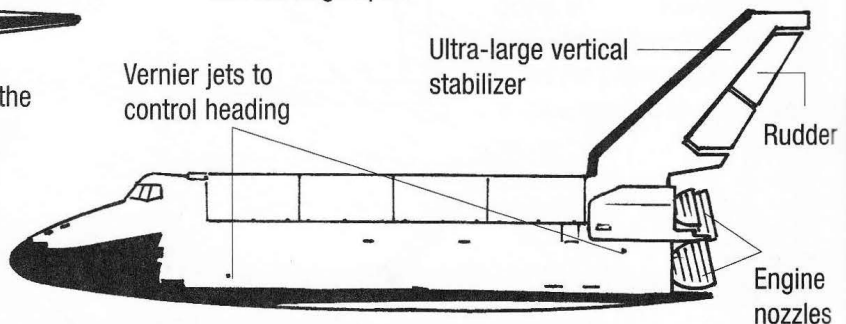
The space shuttle has no horizontal stabilizer-only main wings.

Mid fuselage for load carrying

Elevator



Shuttle with the mid fuselage open



Vernier jets to control heading

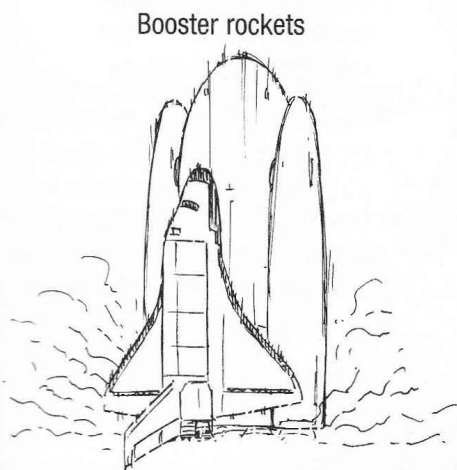
Ultra-large vertical stabilizer

Rudder

Engine nozzles

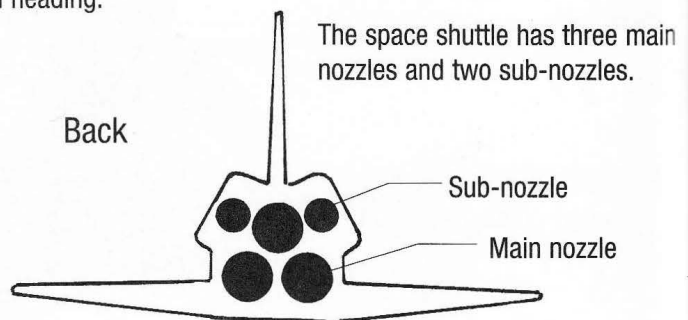
The rudder and elevators are not used in space. Instead, the vernier jets are used to control heading.

Side



Booster rockets

The booster rockets are used to launch the space shuttle orbiter into space. Expanded energy is needed to escape the earth's atmosphere; however, the orbiter itself has no such capability. Consequently, booster rockets are needed for the launch.

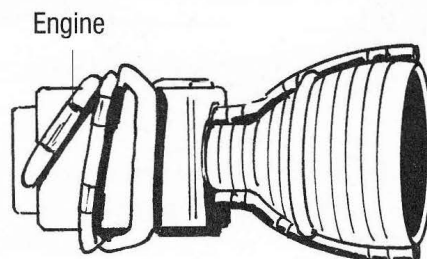


The space shuttle has three main nozzles and two sub-nozzles.

Back

Sub-nozzle

Main nozzle



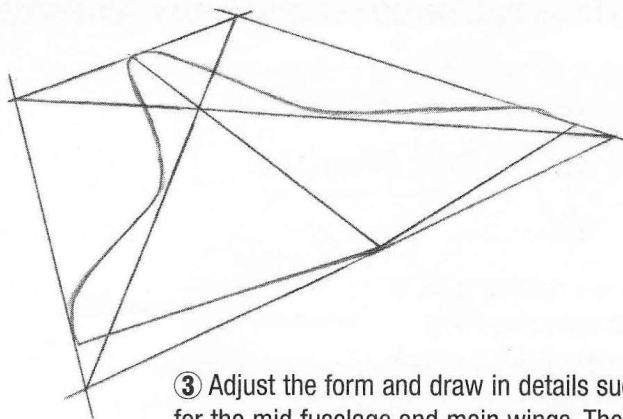
Engine

**Booster (Rocket engine)**  
This engine is designed to move the shuttle in space.

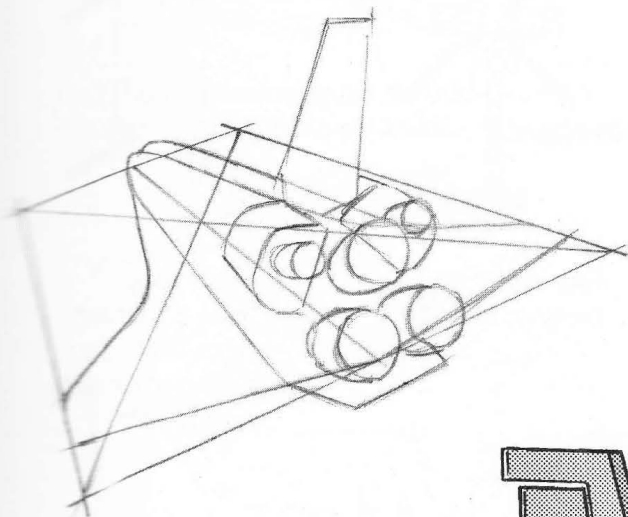
Engine nozzle

## Drawing a Space Shuttle

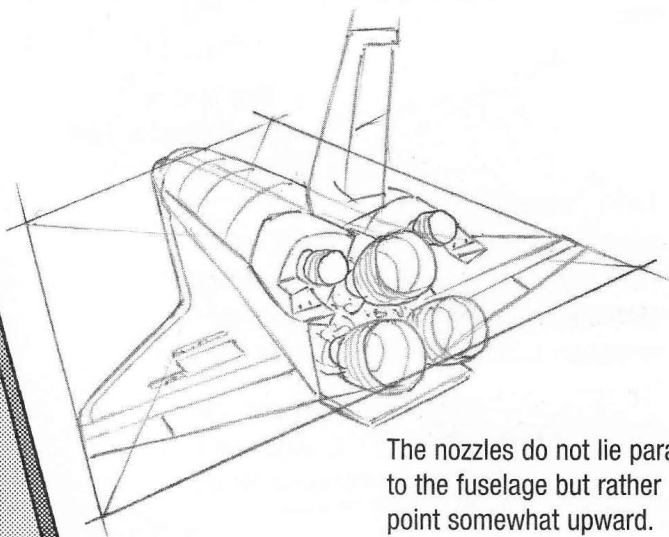
① Draw the bottom of the space shuttle inside the map base.



② Build up a three-dimensional form from the bottom. Make the vertical stabilizer large to obtain a composition with impact. In addition, sketch roughly where the nozzles will lie.



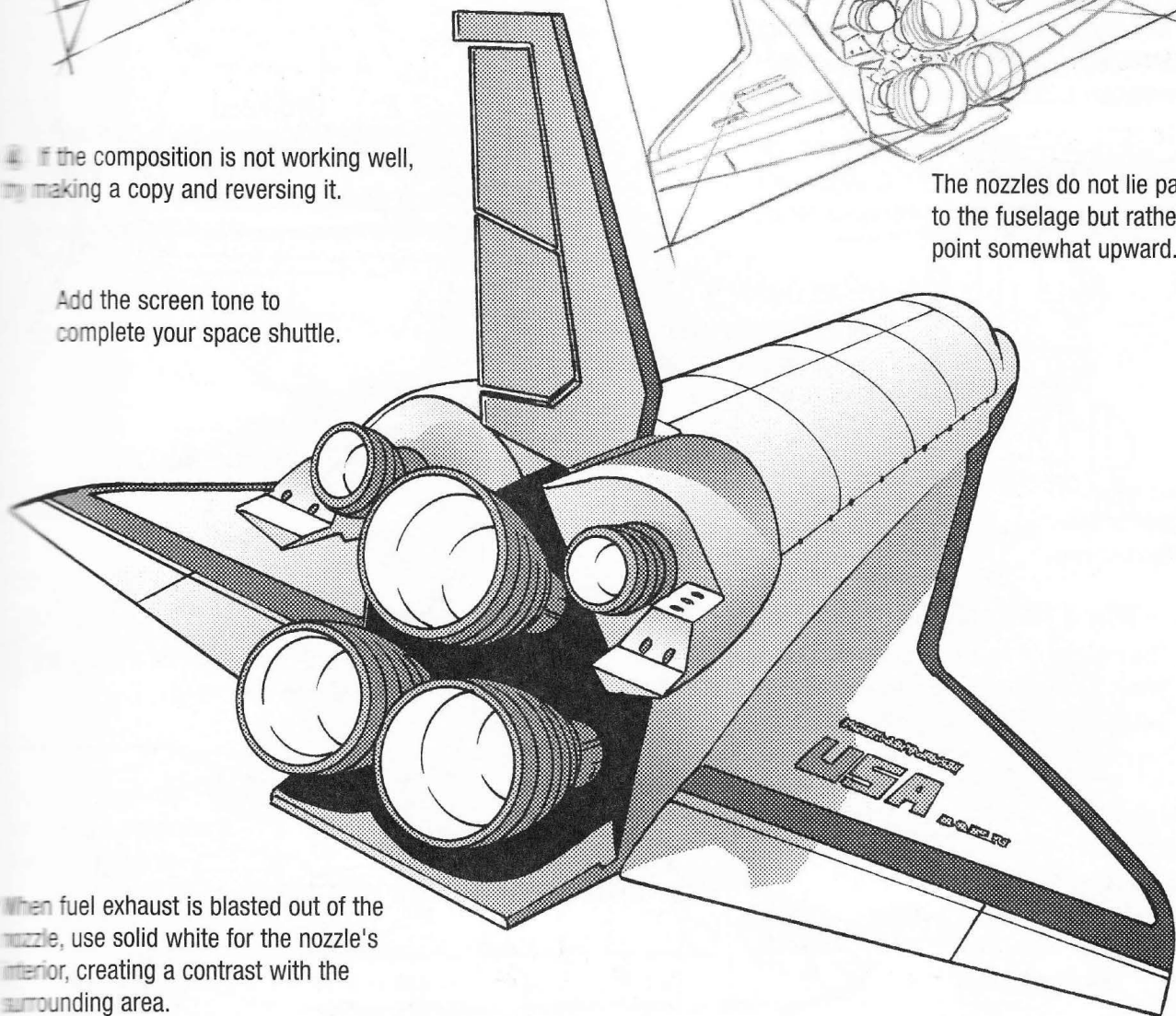
③ Adjust the form and draw in details such as lines for the mid fuselage and main wings. The engine is the key feature of any mecha, so render it carefully.



④ If the composition is not working well, try making a copy and reversing it.

Add the screen tone to complete your space shuttle.

The nozzles do not lie parallel to the fuselage but rather point somewhat upward.



When fuel exhaust is blasted out of the nozzle, use solid white for the nozzle's interior, creating a contrast with the surrounding area.

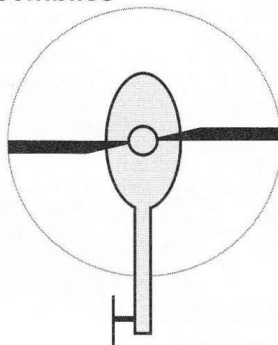


## The Sole Aircraft Capable of Hovering Motionless: Helicopters

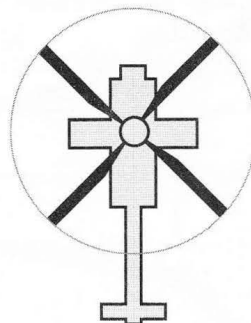
Helicopters fly by the grace of multiple, special rotating wings or blades called "rotors."

### Three-Types of Rotor Assemblies

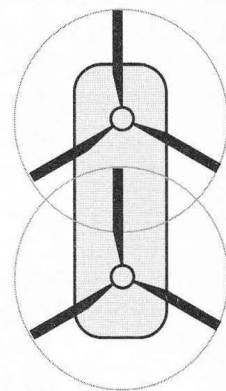
A rotor is a rotating wing. Its rotation generates thrust. The more rotors, the greater the thrust, the more mobility you have. However, the engine's load increases as well.



**Two blades**  
Most common type



**Four blades**  
Designed for mobility

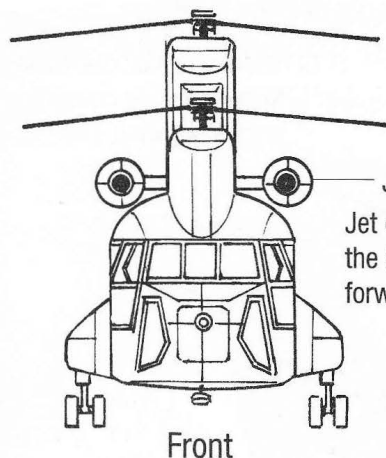


**Three blades**  
These are tandem rotors, which are often used for cargo transport, etc.

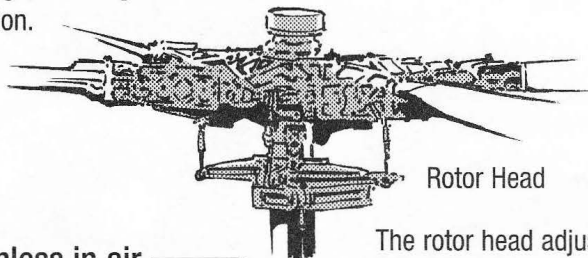
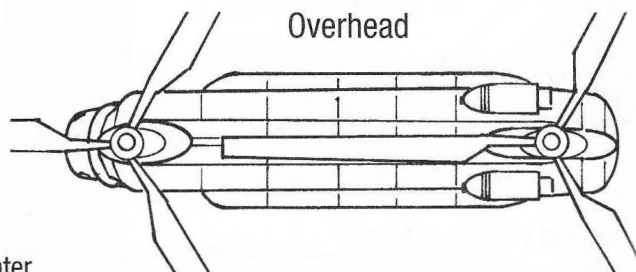
### Twin Rotors

#### Three-Blade Rotor

The boxy fuselage allows for an abundance of cargo to be stacked inside. Two rotors are necessary to balance the extra-heavy fuselage.



Jet engines are used to counter the heavy fuselage, allowing forward propulsion.

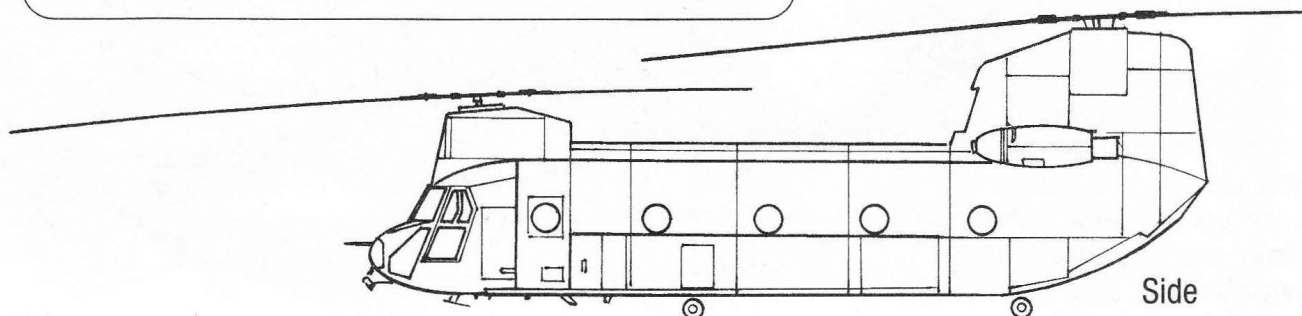


**Rotor Head**

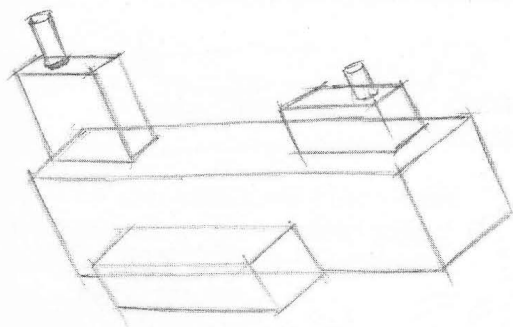
### Why a helicopter can hover motionless in air

The rotation of the helicopter's rotors creates an upward thrust. When a balance has been achieved between (downward) gravity and (upward) thrust, the helicopter is able to hover mid-air.

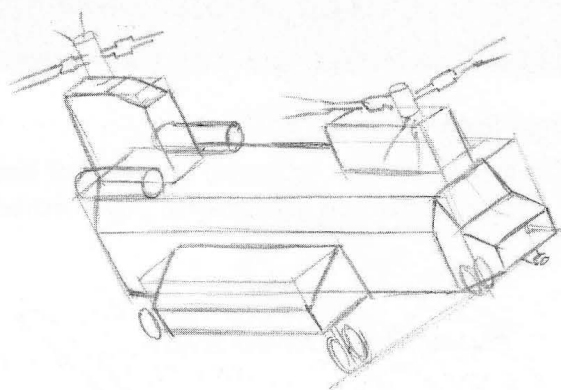
The rotor head adjusts the pitch (direction) of the rotating wings. The largest mechanism on a helicopter is likely the rotor head.



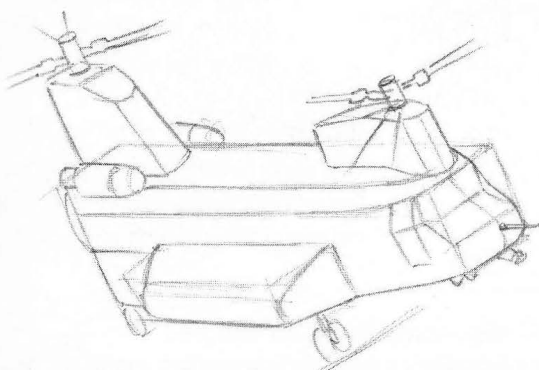
## Drawing a Twin Rotor Helicopter



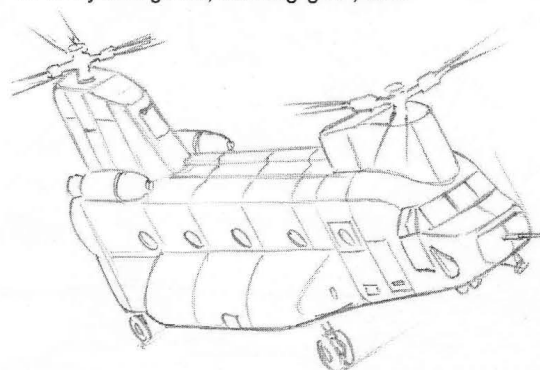
① Build the helicopter out of blocks. Since the fuselage is boxy, use a combination of rectangles.



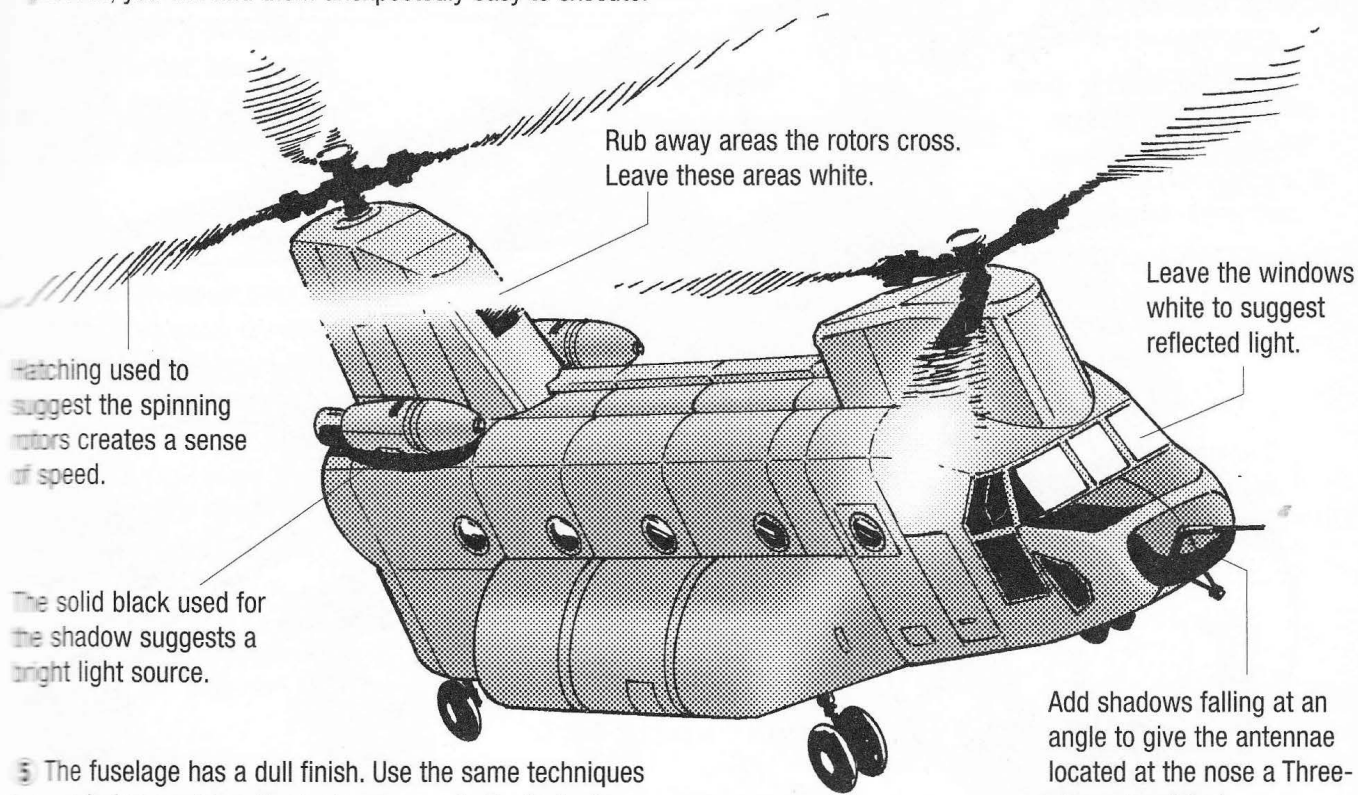
② Trim off any unneeded portions of your blocks and adjust the overall form. Draw only the bases of the blades. Determine the positions of the jet engines, landing gear, etc.



③ Round off sharp corners and edges, giving the form an overall curved feel. The smooth lines used in the long and fuselage sides are difficult to achieve, but if you follow this process, you will find them unexpectedly easy to execute.



④ Draw lines as needed to suggest the steel plates of the body, and add in details for the windows and engines.

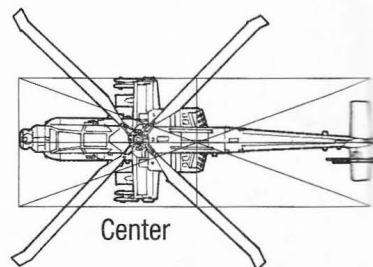
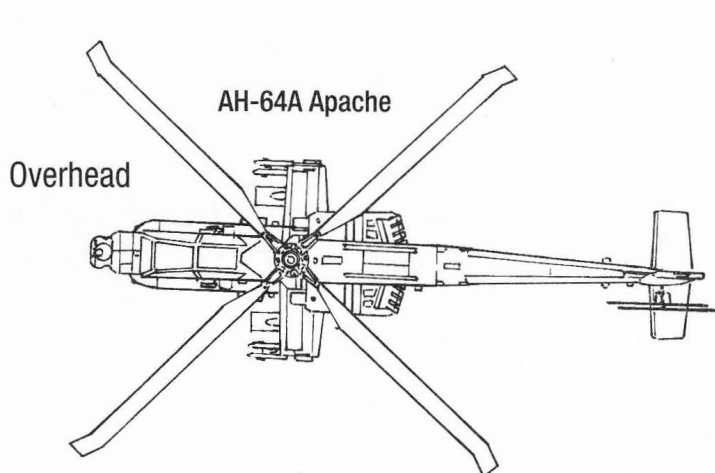


⑤ The fuselage has a dull finish. Use the same techniques for rendering a rubber-like texture to create the look of an army helicopter. The key to rubber-like textures is to avoid adding white highlights.

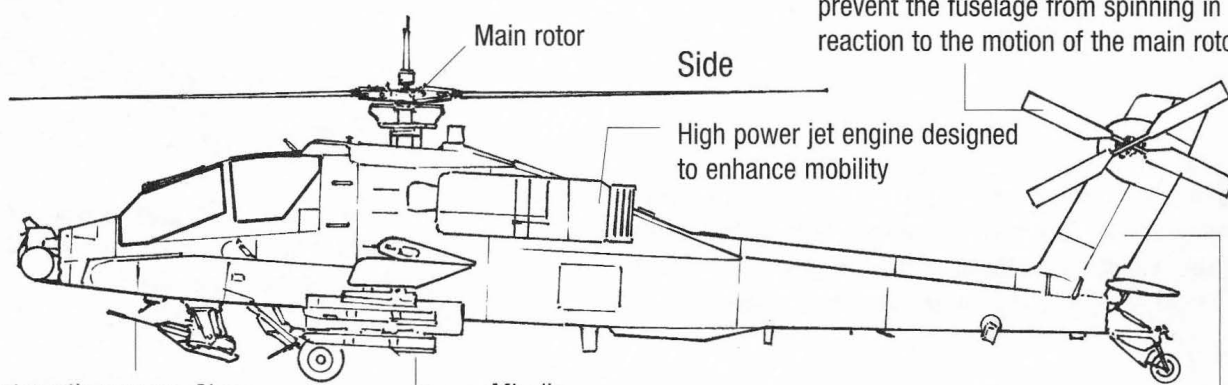
## Aircraft Designed for Mobility: Combat Helicopters

### Single Rotors

This is a four-blade rotor. Increasing the number of blades enhances mobility. Furthermore, the high-powered engine reduces the engine's load.

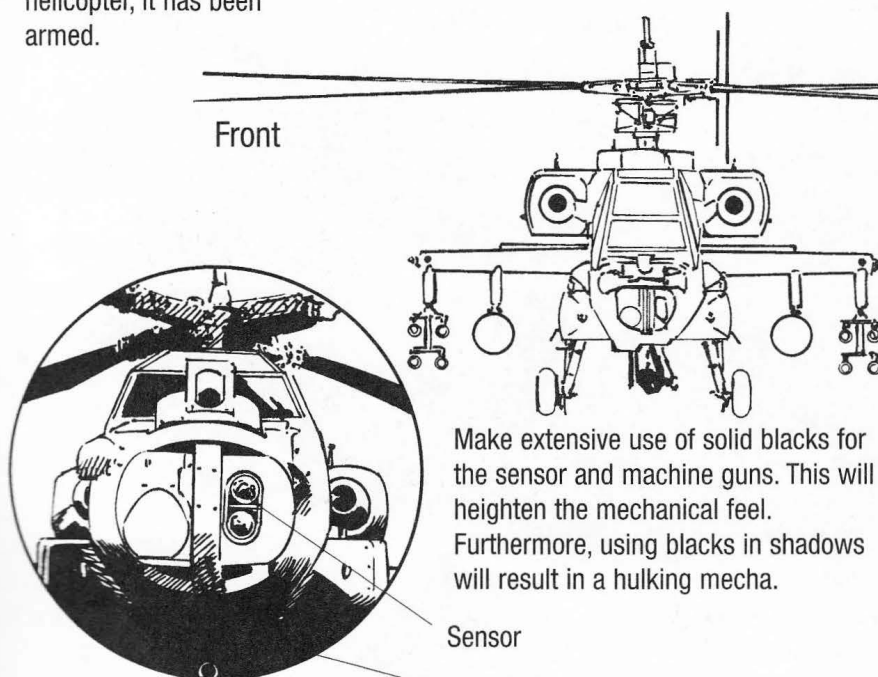


When the fuselage is complex in form, always determine where the center lies first.



Automatic cannon: Given that this is a combat helicopter, it has been armed.

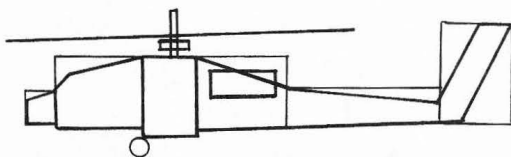
The vertical stabilizer provides stability when flying forward.



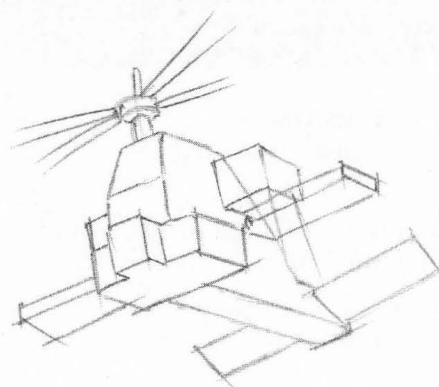
Combining solid black with white highlights on the weapons creates a contrast that is superb for generating a sense of heaviness.

M230EI  
30 mm automatic  
cannon (Chain gun)

## Drawing a Combat Helicopter



① Dividing up the body roughly into simple blocks will make it apparent that even a complex-looking form can actually be unexpectedly straightforward.



② Once you have laid out the composition, build up the form with the blocks you used to divide the body in step ①.



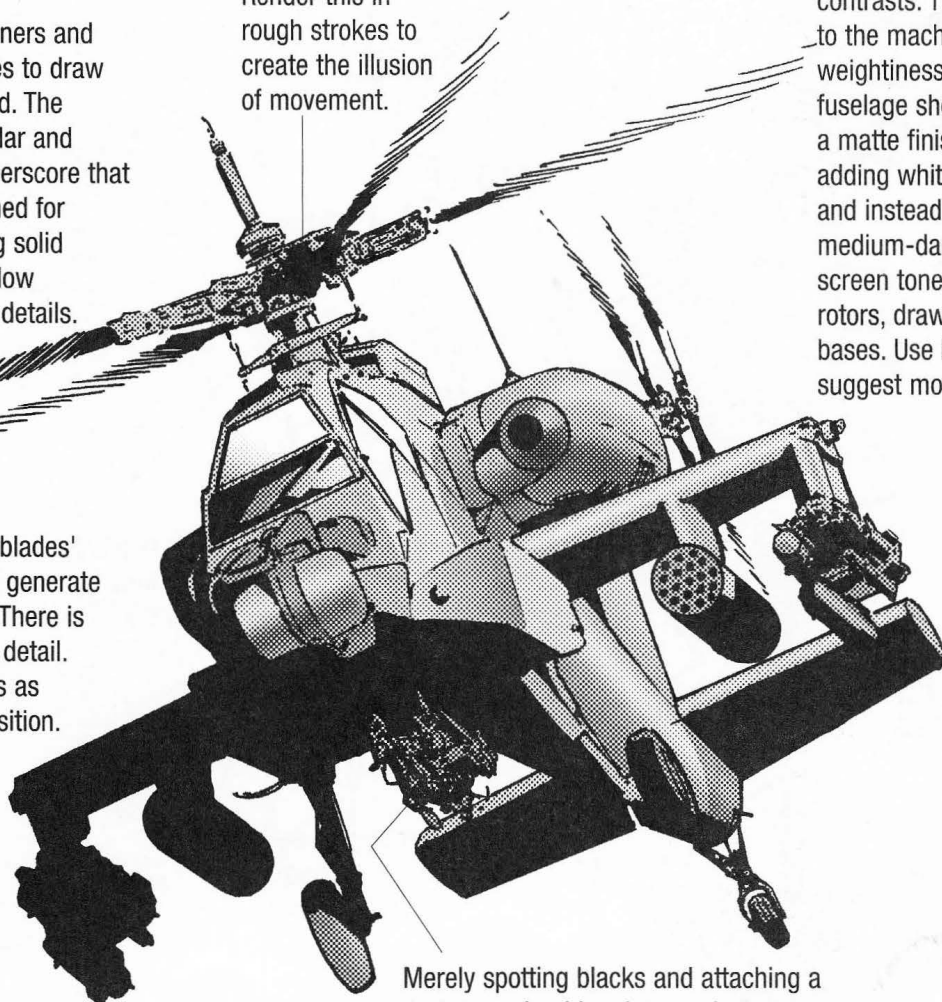
③ Using cubes and cylinders will make it easier to construct missiles, automatic cannons, and other supplementary parts.

④ Round off sharp corners and edges. Use sharp angles to draw the cockpit's windshield. The contrast between angular and rounded forms will underscore that the helicopter is designed for combat. Further, adding solid blacks to areas of shadow precludes the need for details.

Render this in rough strokes to create the illusion of movement.

⑤ Make bold use of blacks, strengthening contrasts. This will add to the machine's weightiness. The fuselage should have a matte finish, so avoid adding white highlights, and instead apply medium-darkness screen tones. For the rotors, draw only the bases. Use hatching to suggest movement.

Roughly sketching the blades' complicated bases will generate a sense of movement. There is no need to draw every detail. Simply draw the details as required by the composition.



Merely spotting blacks and attaching a dark tone should make your helicopter look sufficiently mecha-ish.

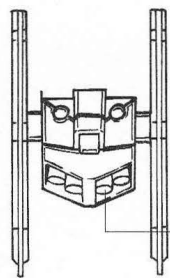


## Practice: Making a Human Fly

Let's equip a human with a couple of necessary items—wings and a propulsion device—to allow her to fly.

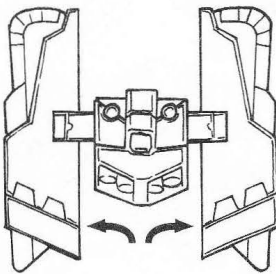
### Combining Wings and a Thruster Backpack into a Single Unit

We will dress our girl in a wing/propulsion device-combo backpack.

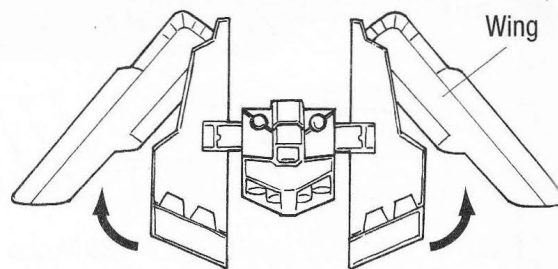


**Main thruster**  
This propulsion device is the main unit of the rocket nozzle, etc.

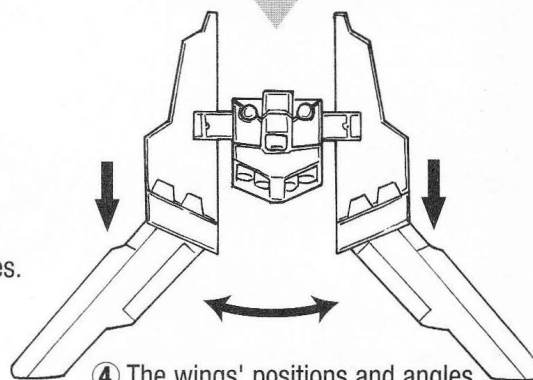
① Still mode:  
The wings are folded and tucked away.



② The wings drop to the sides.

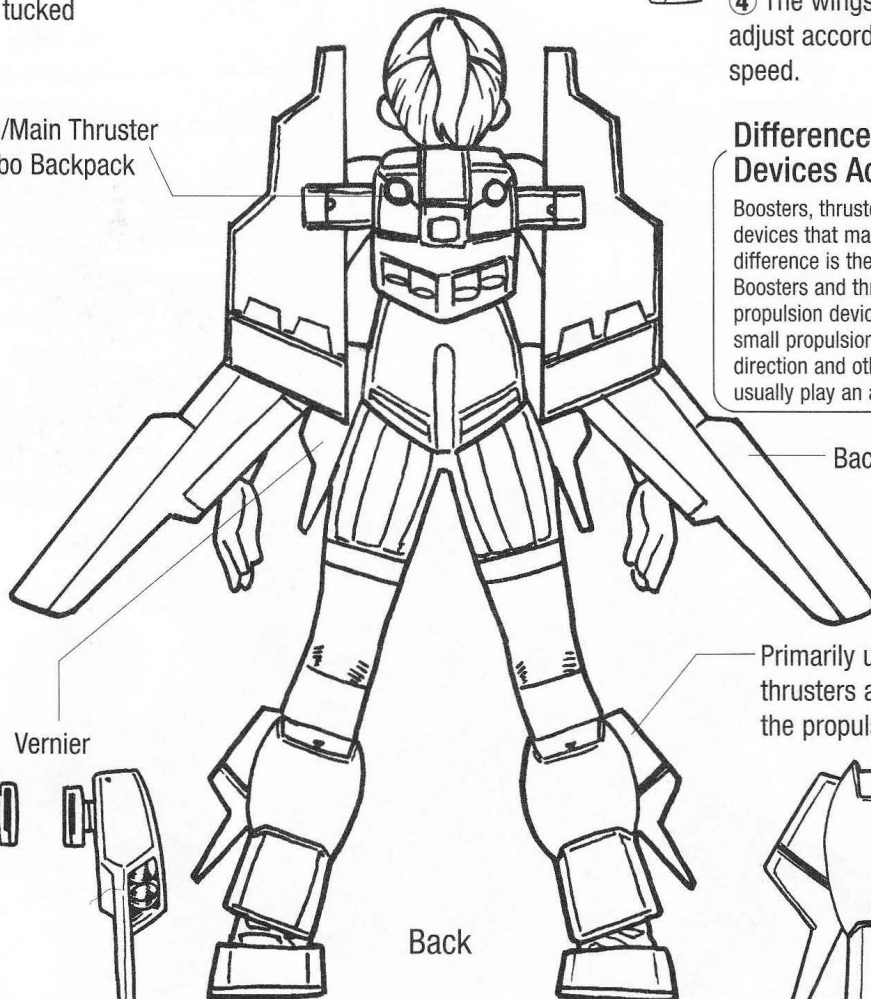


③ The folded wings expand.



④ The wings' positions and angles adjust according to the propulsion speed.

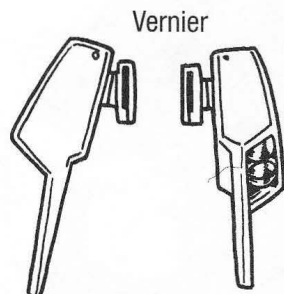
Wing/Main Thruster  
Combo Backpack



### Differences between Propulsion Devices According to Power

Boosters, thrusters, and verniers are all propulsion devices that make use of rocket engines. The difference is the power output during flight. Boosters and thrusters are large, high-powered propulsion devices used for flight. Verniers are small propulsion devices, primarily used to adjust direction and otherwise control handling. They usually play an auxiliary role.

Backpack with wings expanded

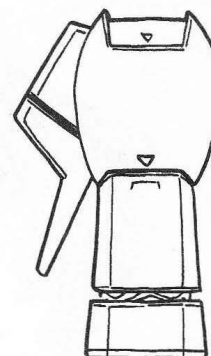


Vernier

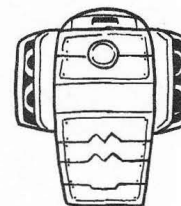
A propulsion device designed to change direction

Back

Primarily used for acceleration, sub-thrusters act as auxiliaries to boost the propulsion of the main thruster.

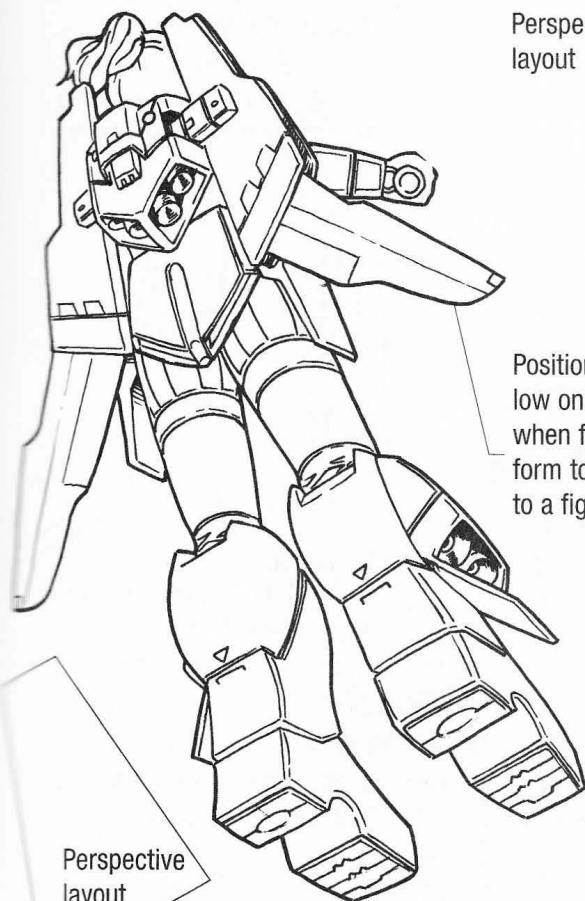


Back view of leg



Base of foot

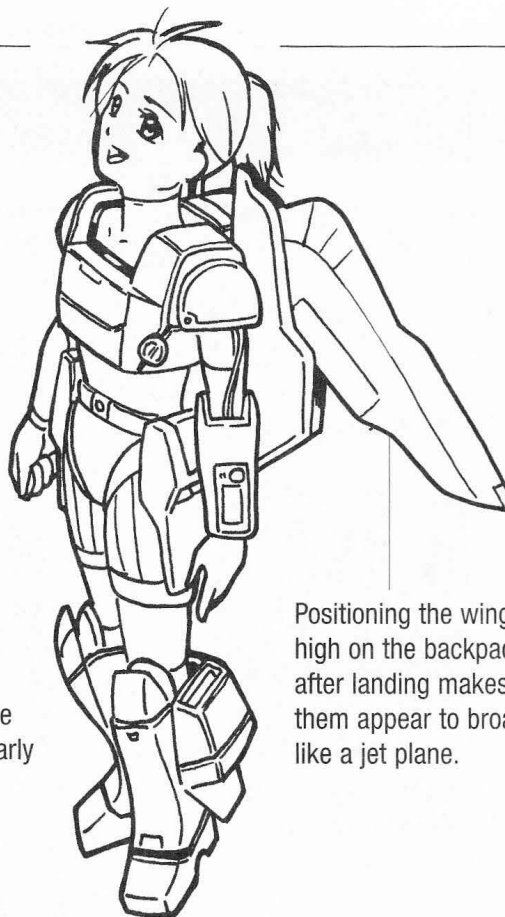
Use foreshortening to create the illusion of flying. Laying out the composition in simple blocks will suffice. Drawing a figure within these blocks will automatically result in a composition in perspective.



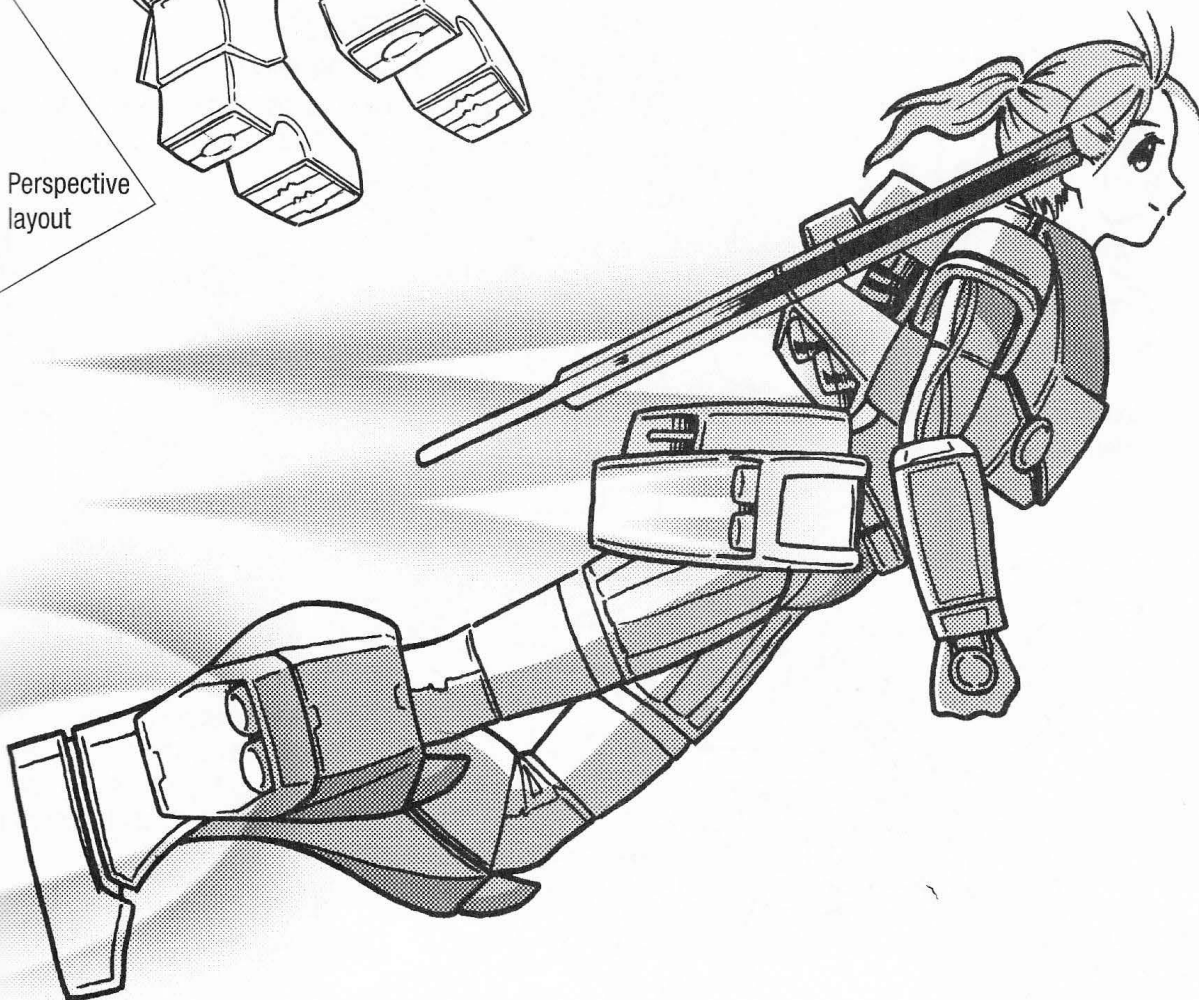
Perspective layout

Perspective layout

Positioning the wings low on the backpack when flying causes the form to broaden similarly to a fighter jet.



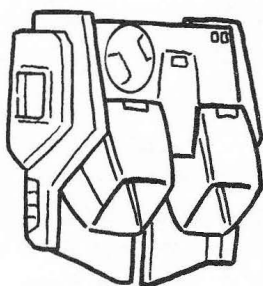
Positioning the wings high on the backpack after landing makes them appear to broaden like a jet plane.



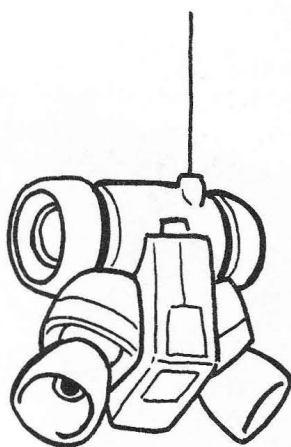
## Flight Armor I: Outfitted Armor

Backpacks and wings worn on the back can come in a variety of shapes. Play around and come up with your own ideas.

### Propulsion Device

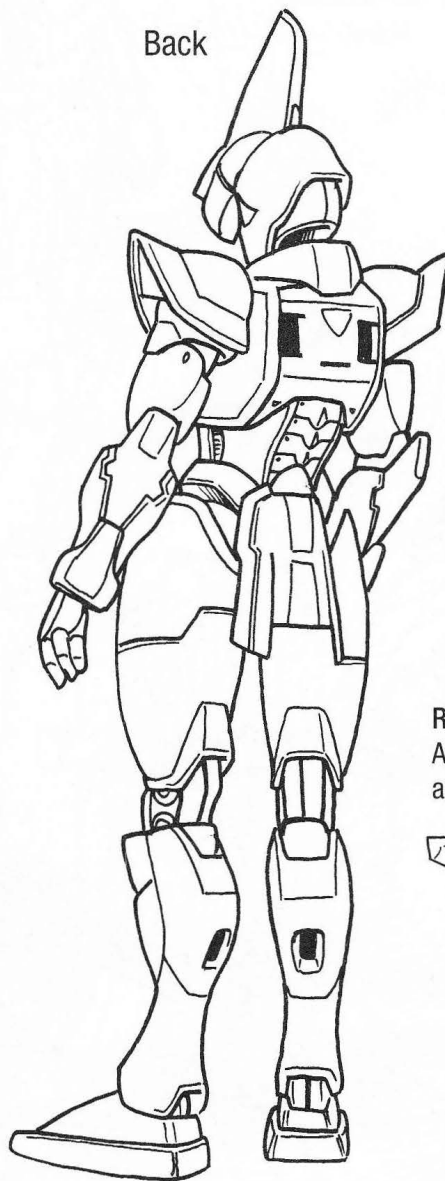


Boxy backpack with internal boosters



Rounded backpack with external boosters

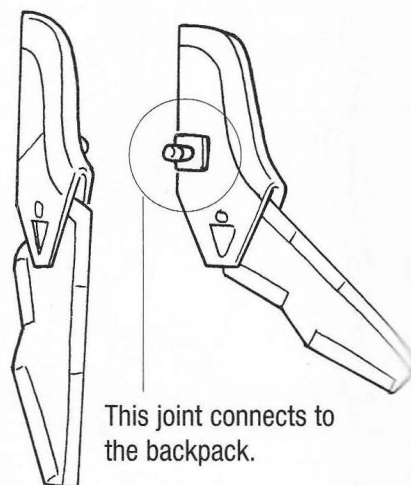
Back



### Wings

#### Adjustable Wings

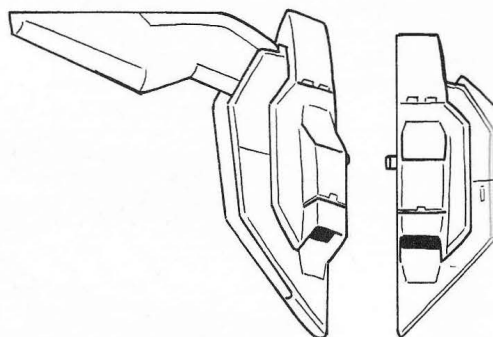
The angles of these wings change when flying, allowing for control over lifting power.



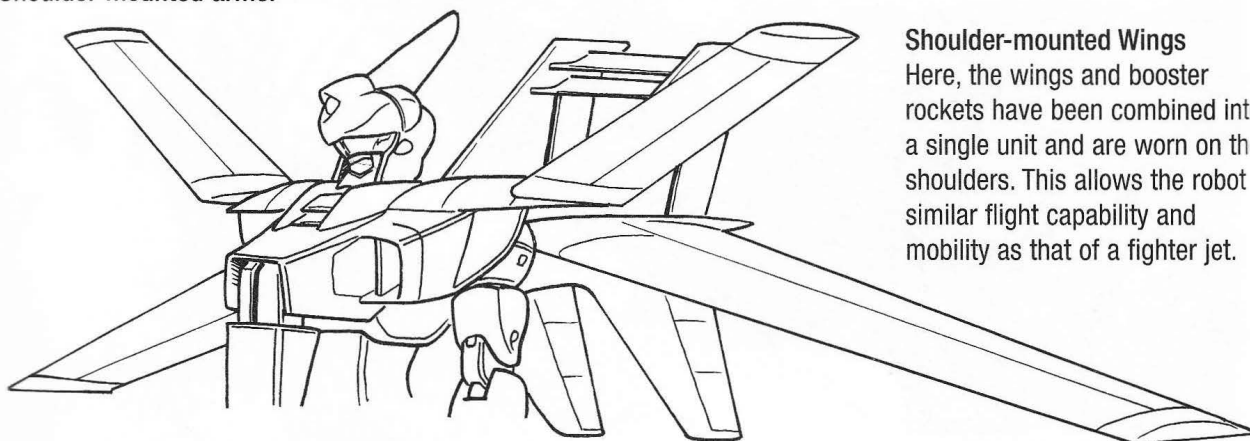
This joint connects to the backpack.

#### Retractable Wings

A smaller model, these wings are folded and tucked away when not in use.



### Shoulder-mounted armor

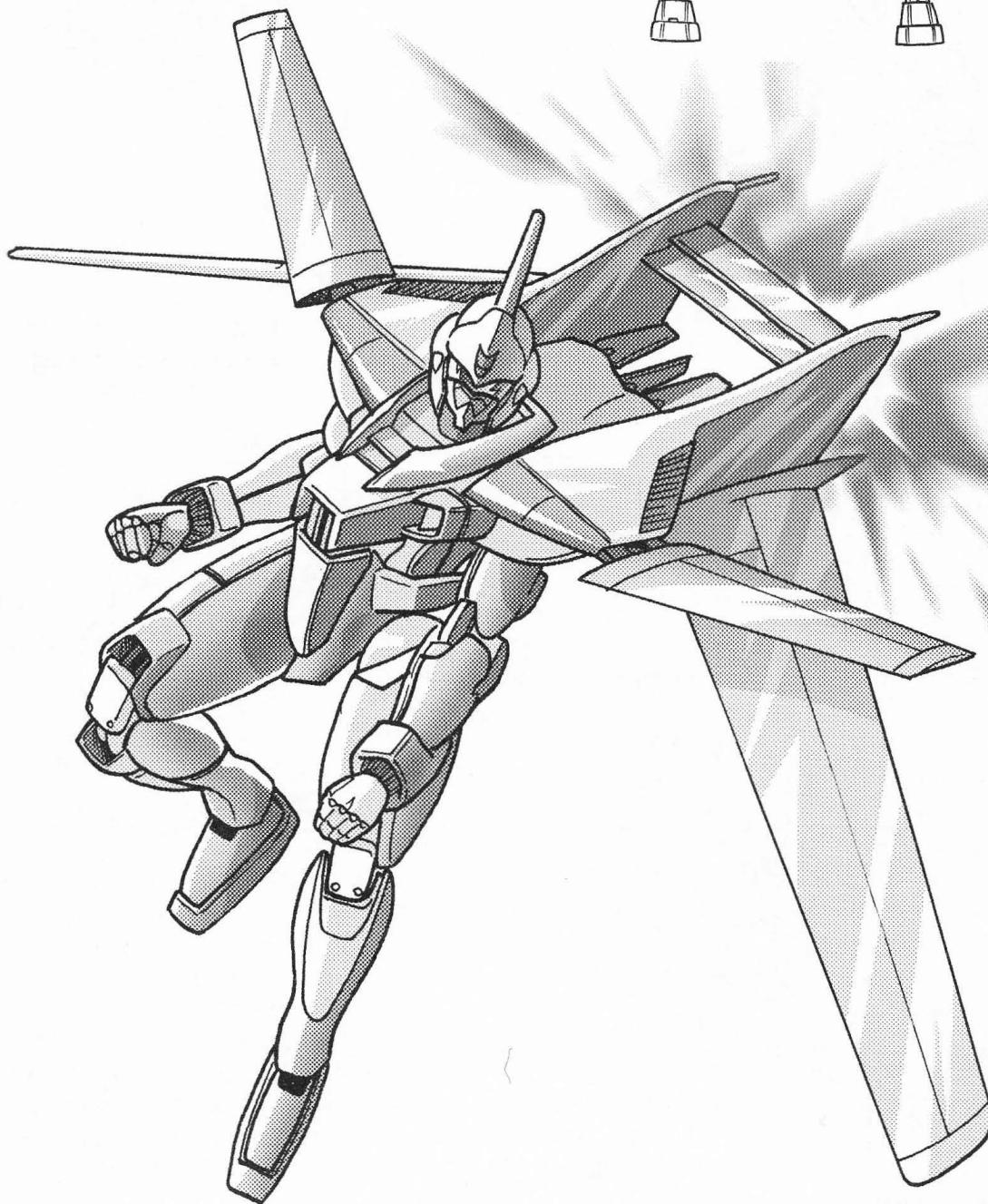
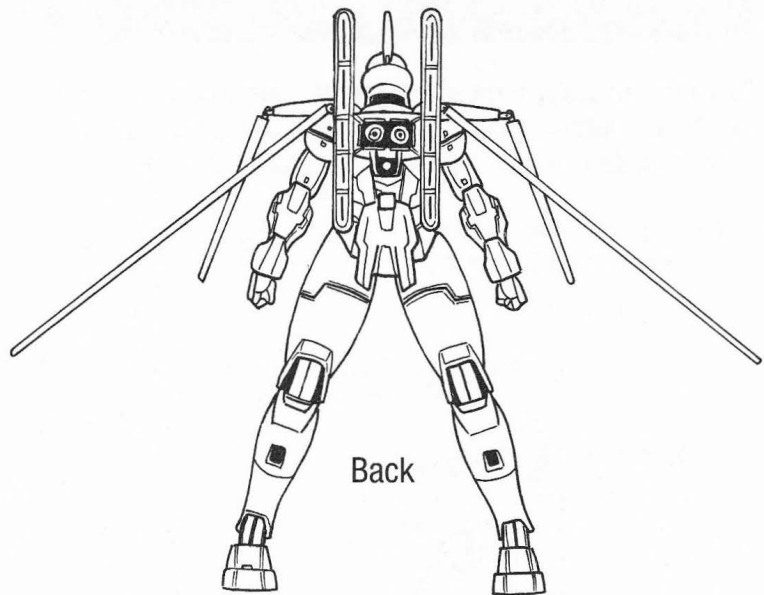


#### Shoulder-mounted Wings

Here, the wings and booster rockets have been combined into a single unit and are worn on the shoulders. This allows the robot similar flight capability and mobility as that of a fighter jet.

### What is "armor"?

While there is armor in the traditional sense, "armor" as referred to here means a combat robot dressed in armor. "Flight armor" refers to a flying combat robot designed for midair battle.

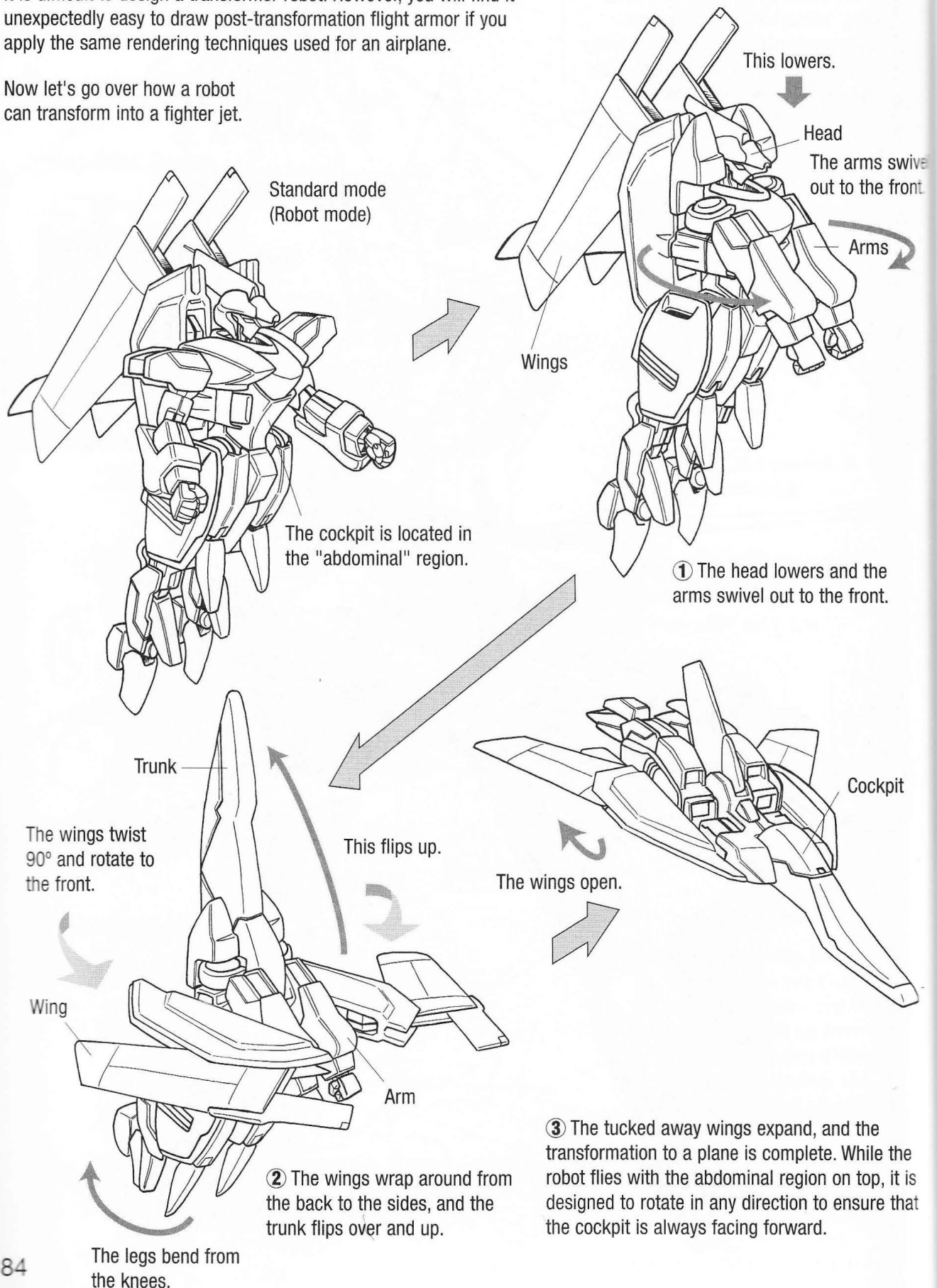


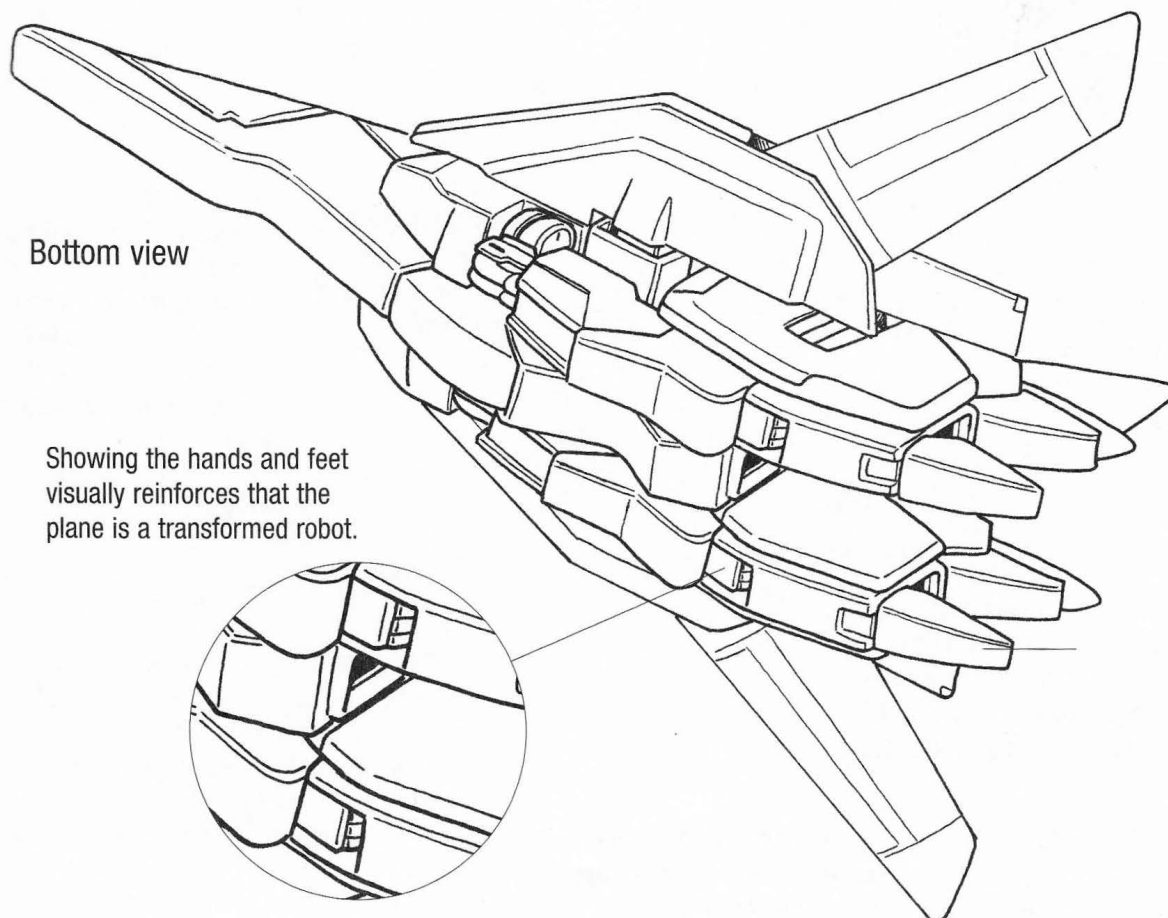
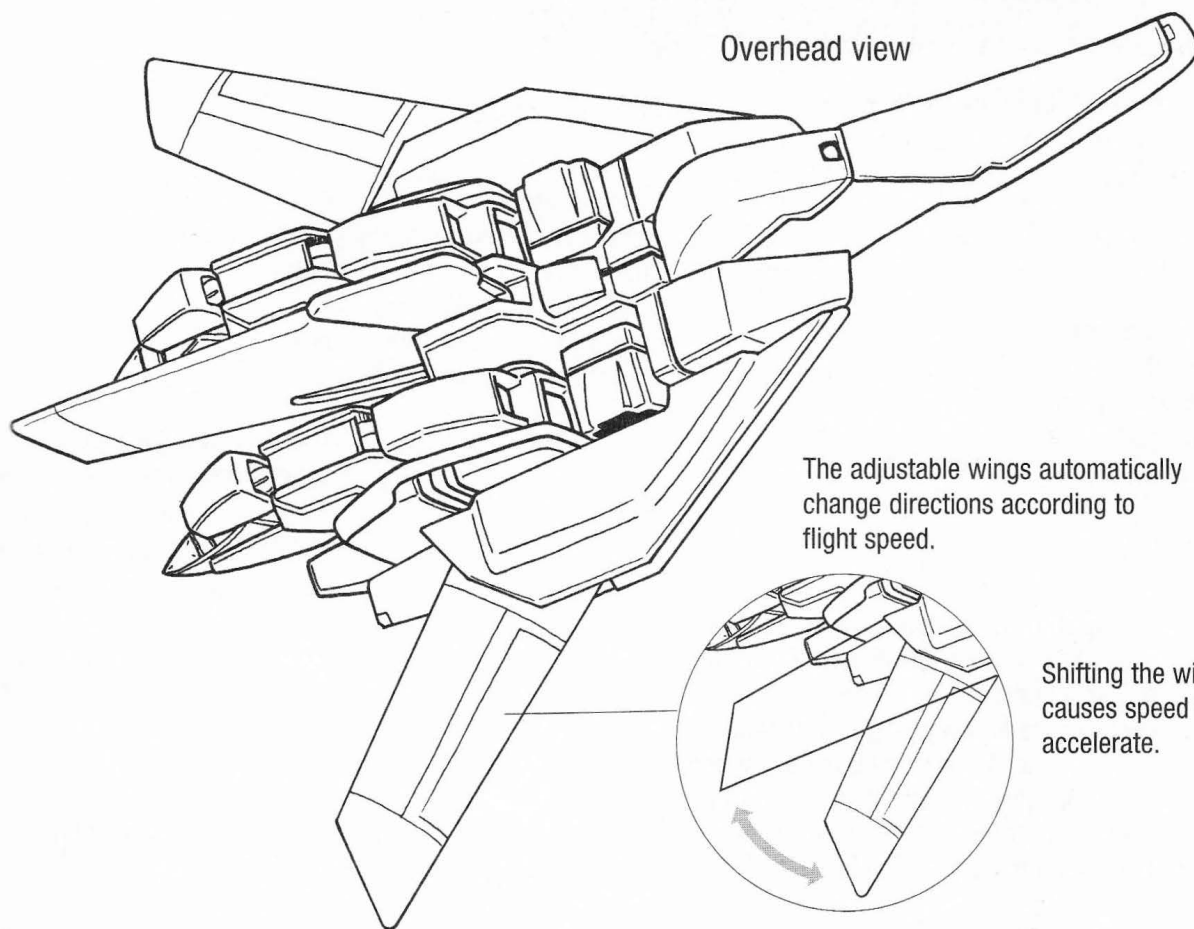


## Flight Armor II: Transformer Armor

It is difficult to design a transformer robot. However, you will find it unexpectedly easy to draw post-transformation flight armor if you apply the same rendering techniques used for an airplane.

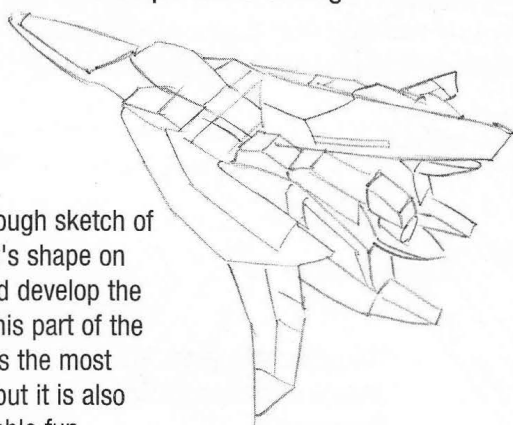
Now let's go over how a robot can transform into a fighter jet.





## Drawing Flight Armor

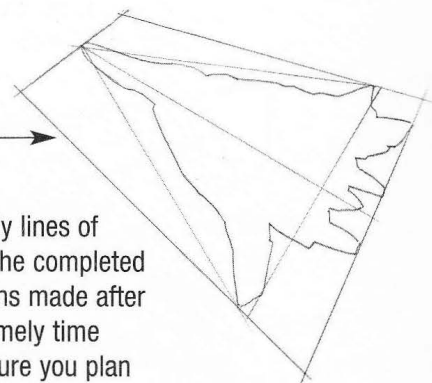
Completed drawing



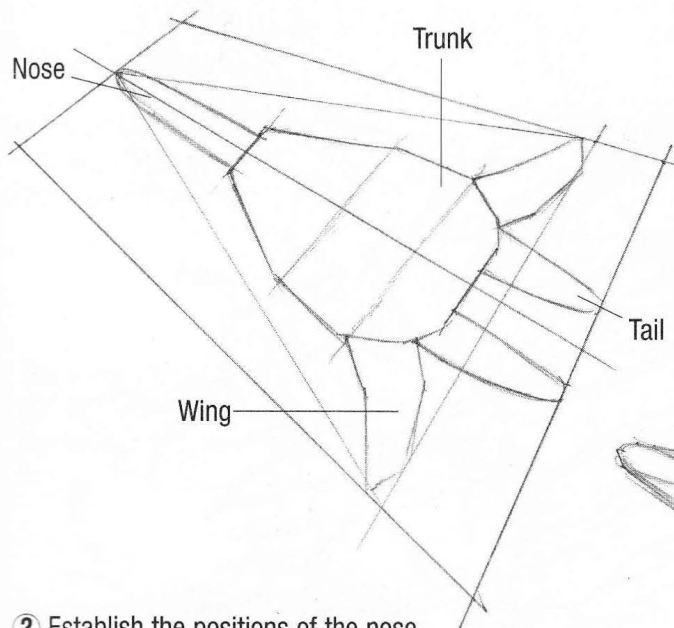
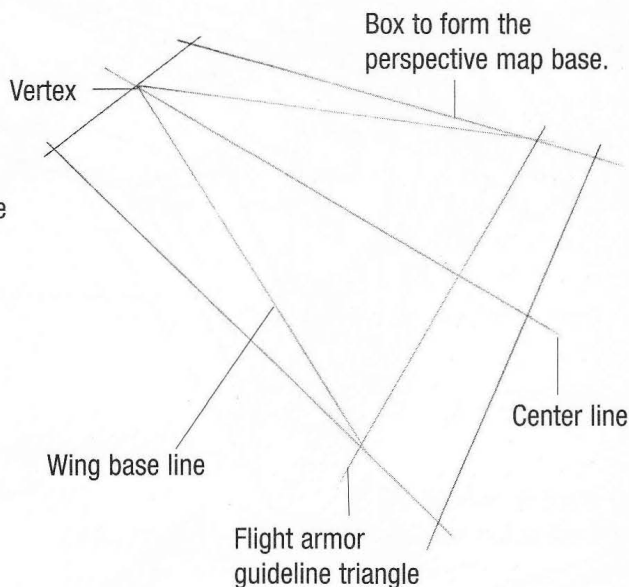
Draw a rough sketch of the plane's shape on paper and develop the image. This part of the process is the most difficult, but it is also considerable fun.

Perspective Guide

Jot down approximately lines of perspective based on the completed drawing. Any corrections made after this point will be extremely time consuming, so make sure you plan out the base map carefully here.



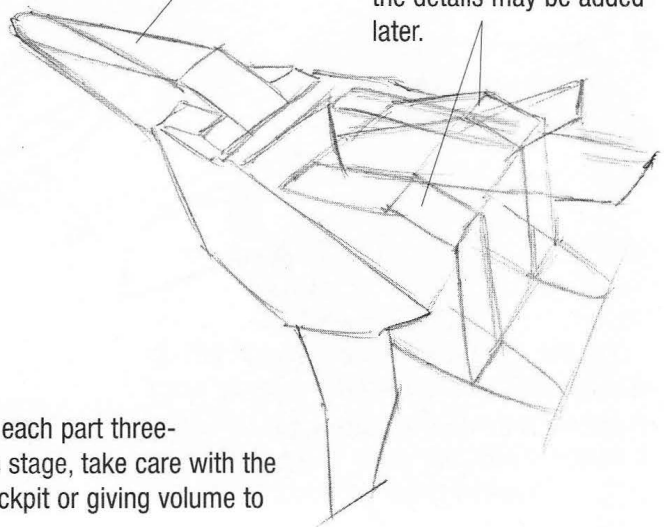
① Adjust the base map using the perspective guide. The resulting box (trapezoid), in which the flight armor will be drawn, will become the guideline for perspective. Furthermore, there is a triangle formed by the center line, a line indicating the wings' bases, and lines drawn from these to the triangle's vertex. These form the actual map base.



② Establish the positions of the nose, trunk, tail, wings, and wing shape. The entire flight armor's shape can be destroyed just by one poorly formed wing, so try to think up an impressive design.

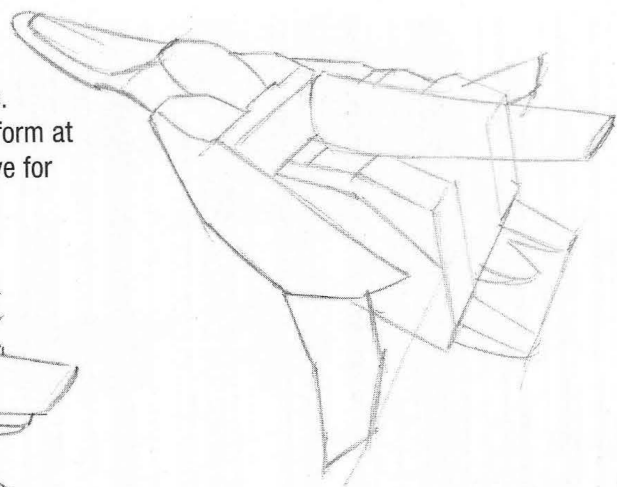
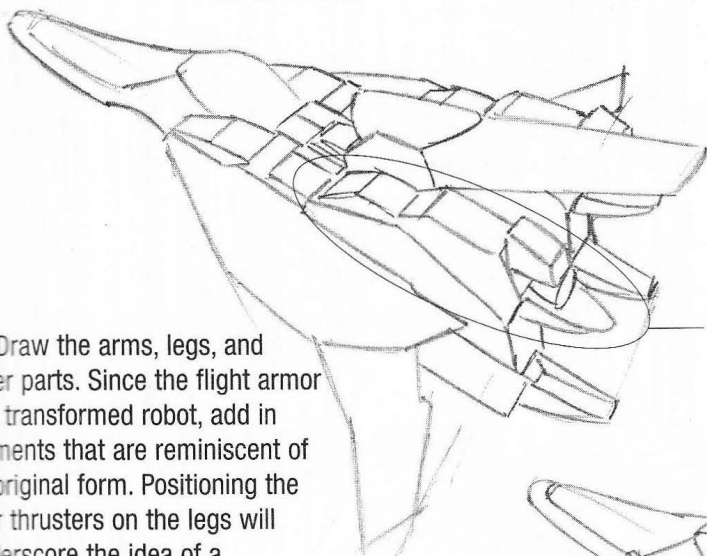
The cockpit is equivalent to the flight armor's face. Take care when drawing the sloped front.

The rear thrusters constitute the largest part and where the bulk of the mecha is located. If you make the thrusters large enough at this point, then the details may be added later.



③ Use cubes to give each part three-dimensionality. At this stage, take care with the sloped front of the cockpit or giving volume to the rear thrusters.

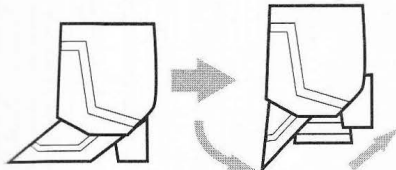
④ Round off sharp edges and corners. Establishing the flight armor's overall form at this stage is extremely important. Strive for attractive lines.



⑤ Draw the arms, legs, and other parts. Since the flight armor is a transformed robot, add in elements that are reminiscent of its original form. Positioning the rear thrusters on the legs will underscore the idea of a transformed robot.

Conceive of the thrusters as legs when drawing.

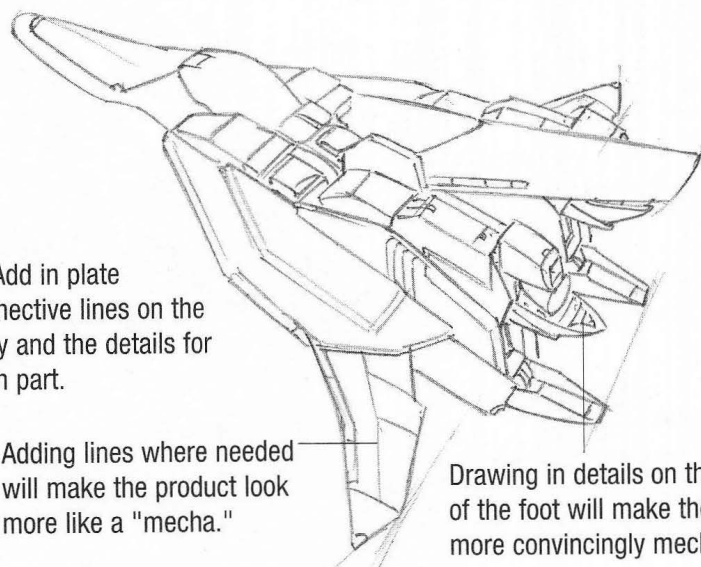
#### Transformation of the Legs



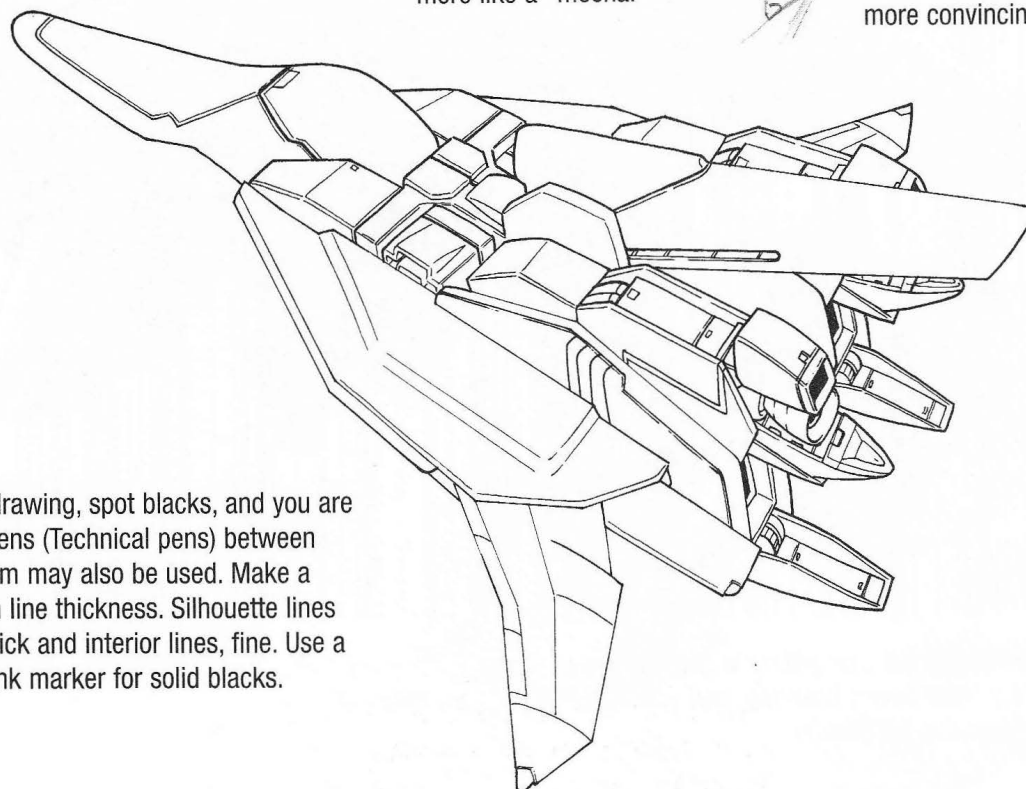
The toe rotates 90°. The heel slides up diagonally, causing the engine nozzle to emerge.

⑥ Add in plate connective lines on the body and the details for each part.

Adding lines where needed will make the product look more like a "mecha."

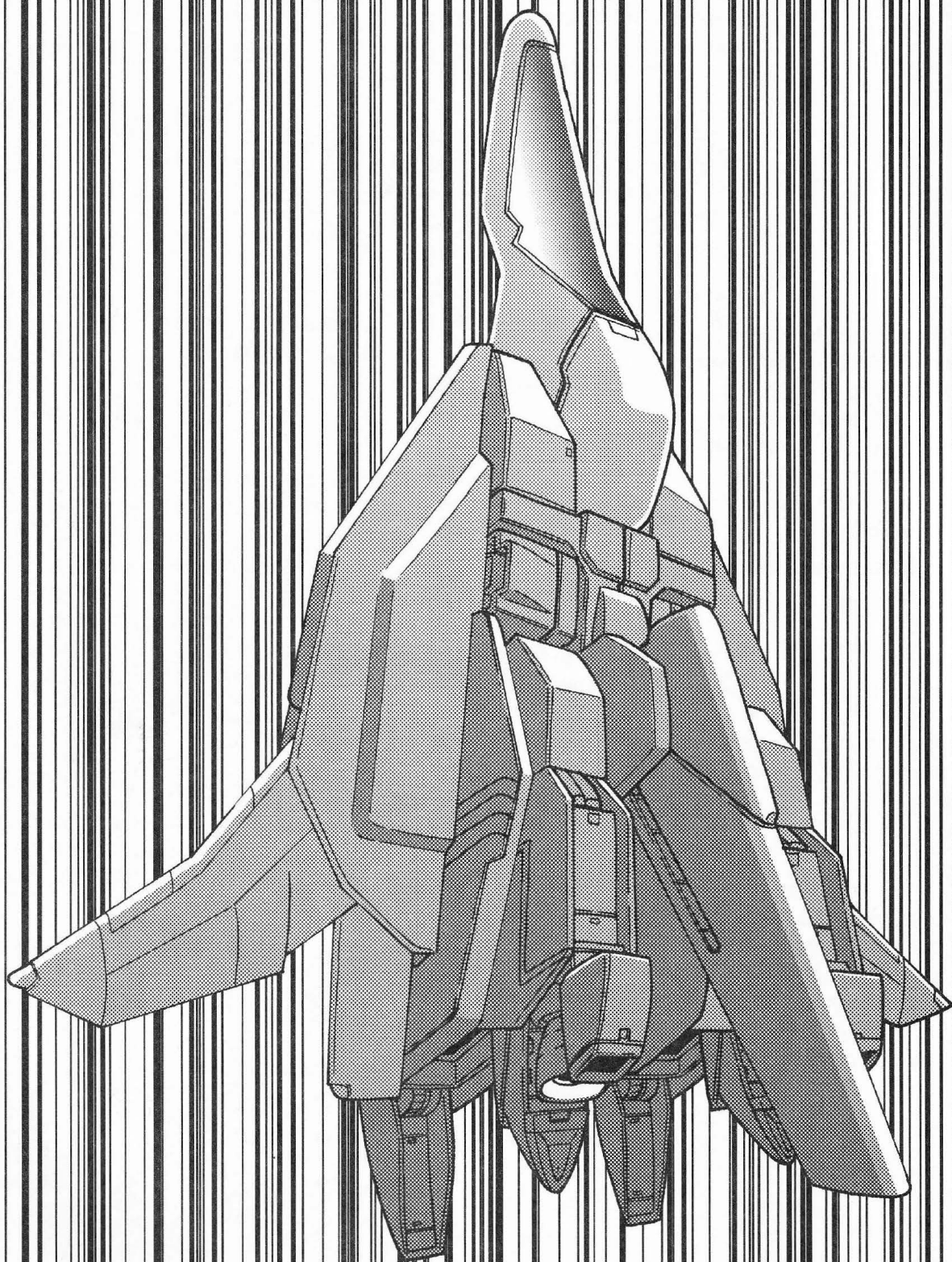


Drawing in details on the back of the foot will make them look more convincingly mechanical.



⑦ Pen the drawing, spot blacks, and you are done. Line pens (Technical pens) between 0.1 to 0.5 mm may also be used. Make a distinction in line thickness. Silhouette lines should be thick and interior lines, fine. Use a permanent ink marker for solid blacks.

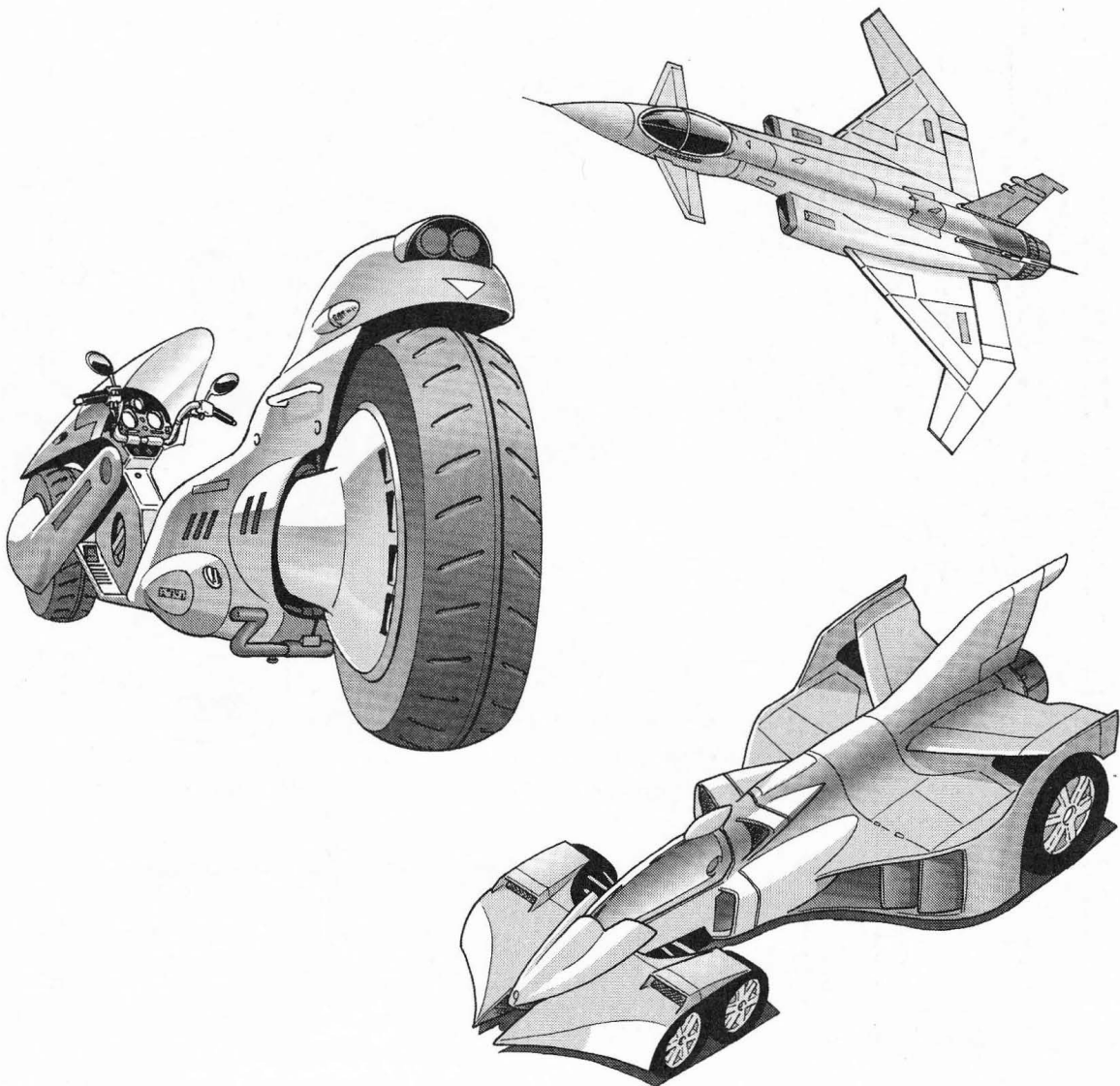




⑦ Add streak lines to the background to gain the feel of speed. Apply screen tones that will provide strong contrasts, and you have finished your image of flight armor ascending full throttle.

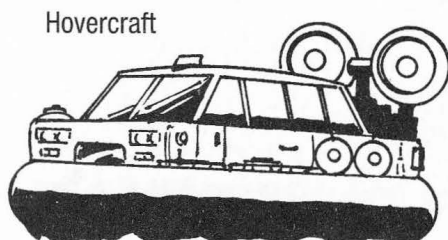
# Chapter 4

## Key Points in Rendering Brainstorm-inspired Ultra Mecha

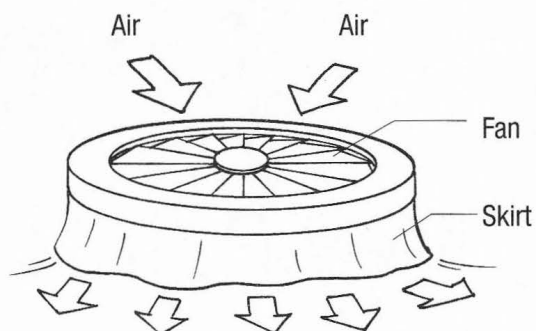


## Using Shifting Concepts to Develop Realistic Designs

Letting your imagination fly will allow you to design a machine with impact. Try bringing together and combining an assortment of elements to devise a mecha overflowing with originality.

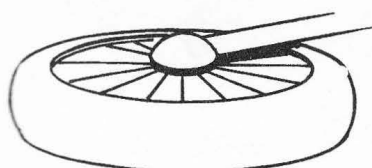
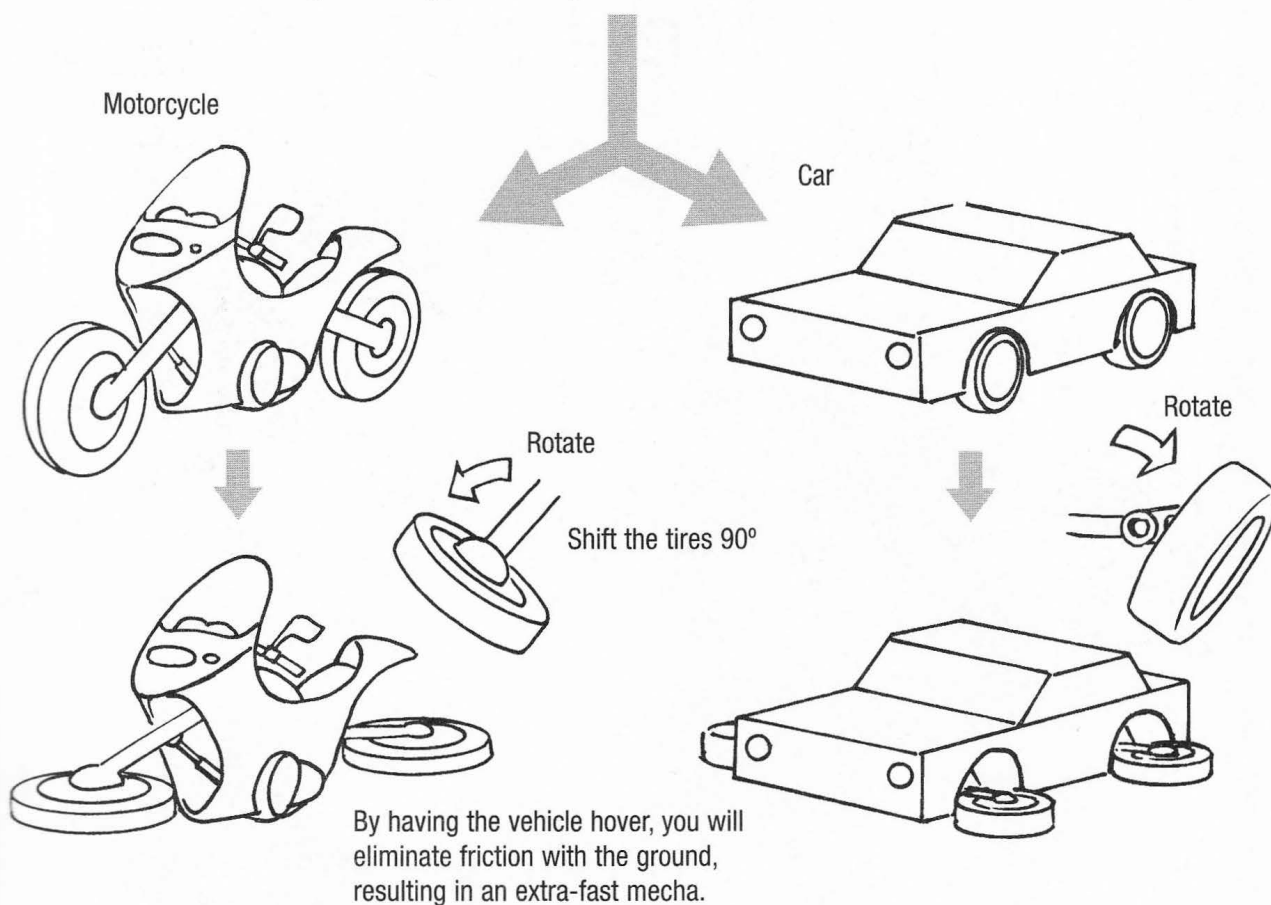


Hovercraft

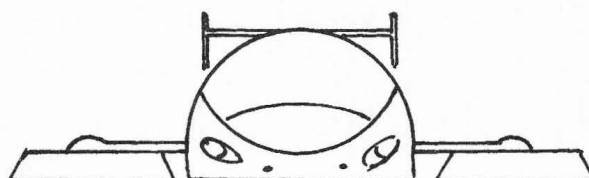


Wind power allows the hovercraft to float.

Example: Using the Principles of Movement of a Hovercraft



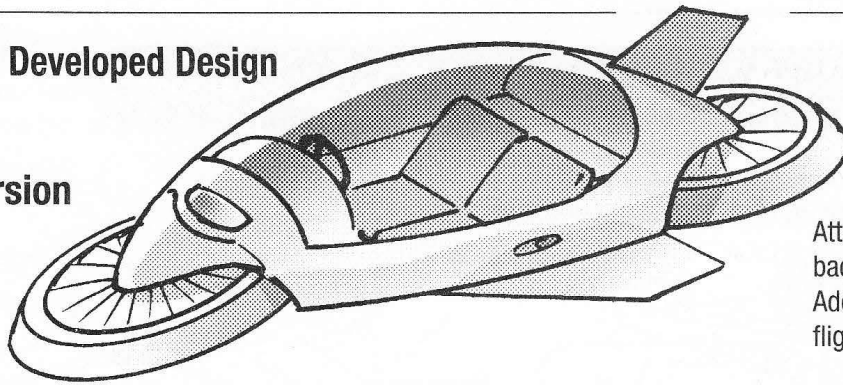
Replacing the wheels with fans results in a novel design.



Replacing the wheels of a motorcycle or a car with a hovercraft motor results in an exciting, fanciful design.

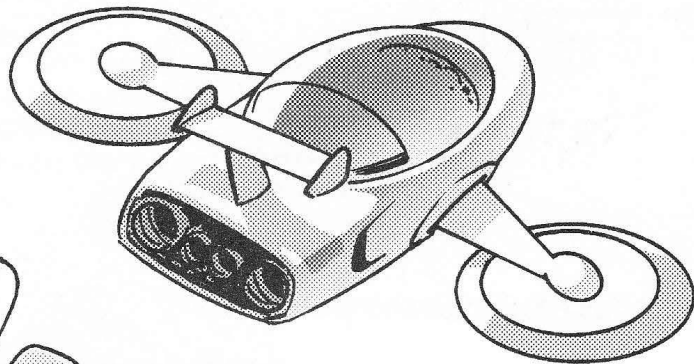
## Sample Developed Design

### Car Version

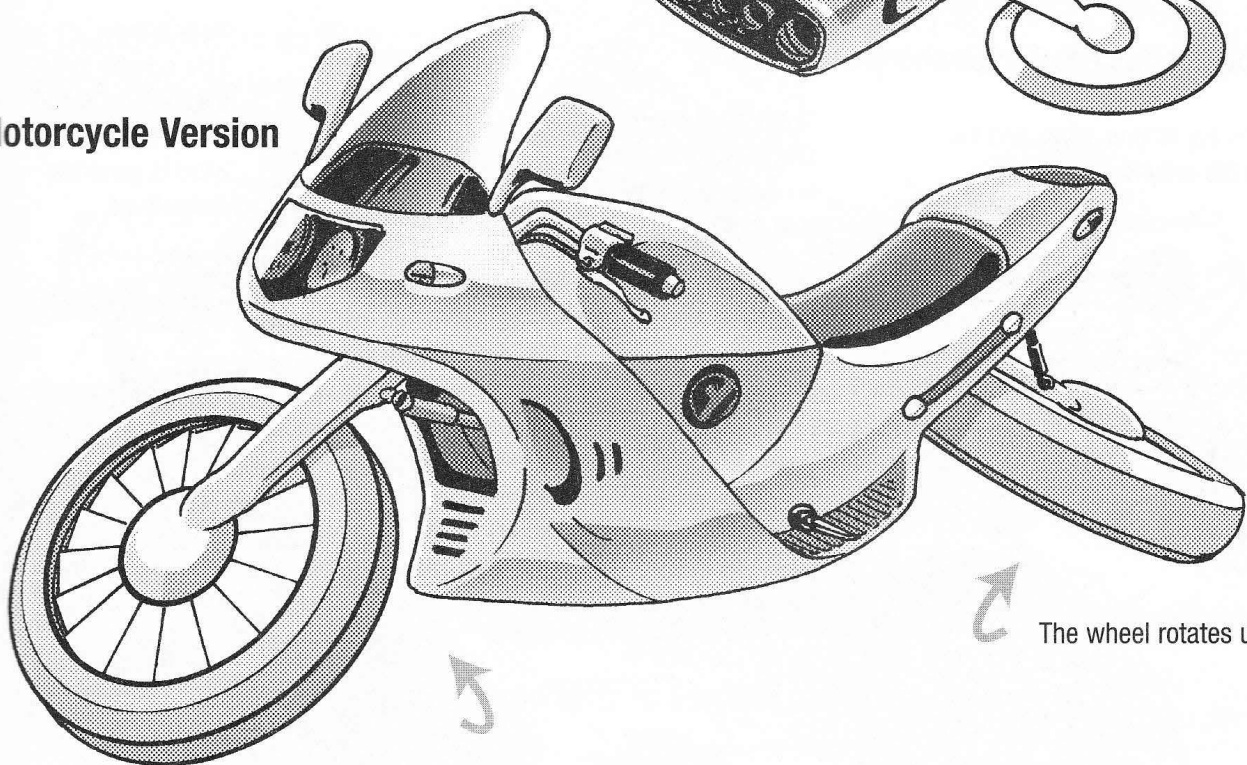


Attaching fans to the front and back yields a car of tomorrow. Adding wings would also enable flight.

Simply attaching a fan to each side results in a futuristic design.



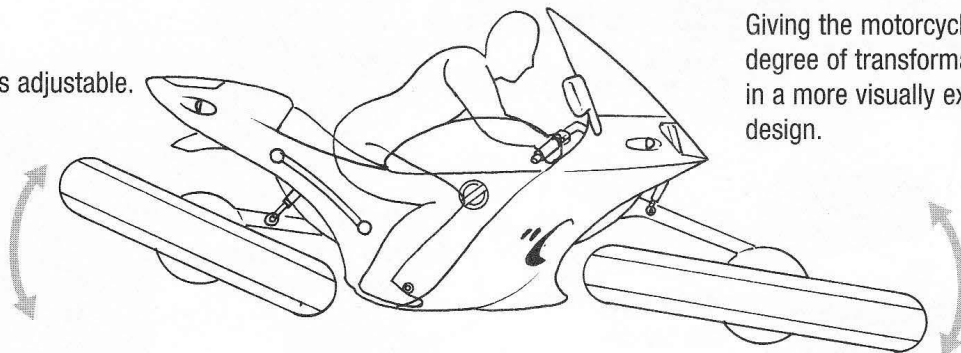
### Motorcycle Version



The wheel rotates up.

Fan/wheel (Hover system)

The fan's angle is adjustable.



Giving the motorcycle a certain degree of transformability results in a more visually exciting final design.

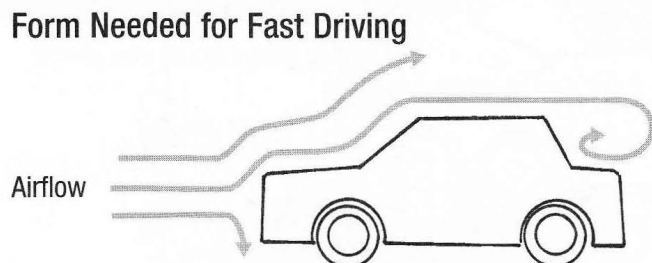
All you need is some tweaking of the original mechanics to produce a fun design.



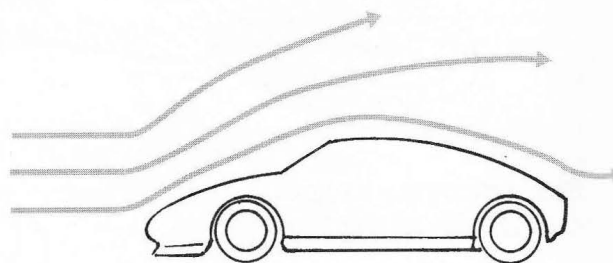
## Mecha Designs Created Simply by Combining "Fast" Elements

There is a host of car types tailored to various purposes. Here, we limit our purposes to the car's drive and devote our attentions toward designing a fast car.

### Form Needed for Fast Driving



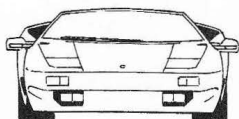
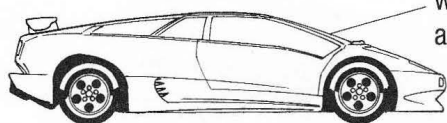
Boxy (minivans) and trapezoidal (sedans, coupes) cars have considerable air resistance and minimal speed.



Rounding off the body allows air to flow smoothly over the car, decreasing air resistance and improving speed.

### Today's Fastest Car: Lamborghini Diablo

The car is long, wide, and low to the ground.

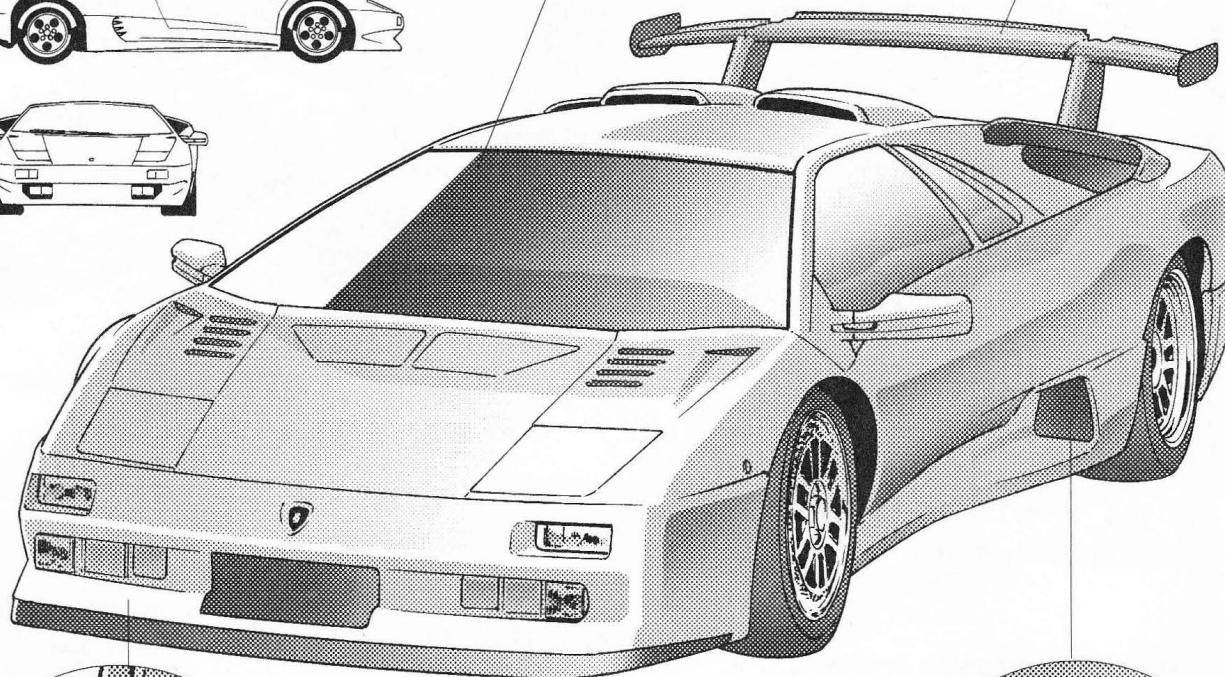


#### Front Windshield

Doing the utmost to reduce air resistance, the front windshield has been tilted to the maximum possible and forms almost a continuous line with the hood.

#### Rear Wing

This adjusts airflow over the car's body by using the force of the wind to generate down force.



#### Front Spoiler

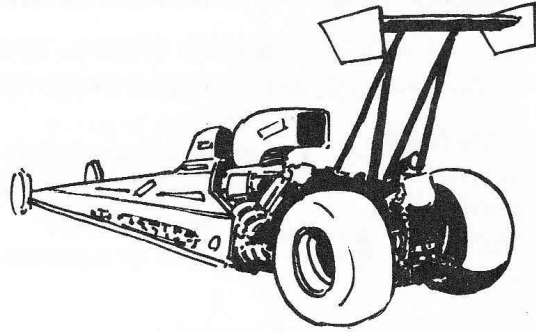
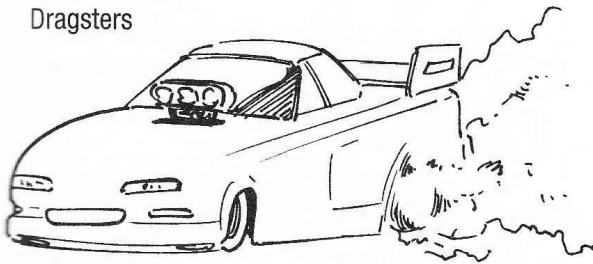
Like the rear wing, this adjusts airflow into the car.

#### Air Intake

This directs air to the engine room and brake system.

Now let's take a look at dragsters, the consummate fast cars, as well as the various parts that help them go fast.

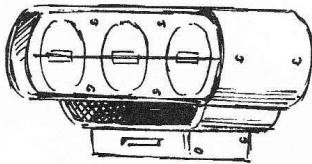
Dragsters



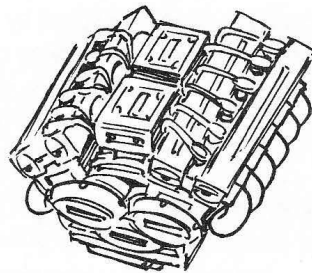
A drag race simply consists of racecars traveling as rapidly as possible over a short distance.

### Parts That Make Cars Go Fast

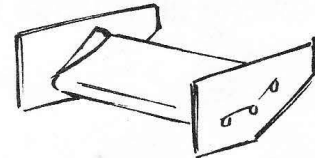
These items enable cars to move even faster.



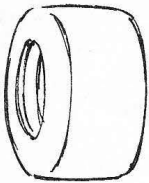
**Supercharger**  
(System for forcing air and fuel into the engine)



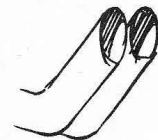
**Large Displacement Volume Engine**



**Large Rear Wing**  
(To direct airflow)

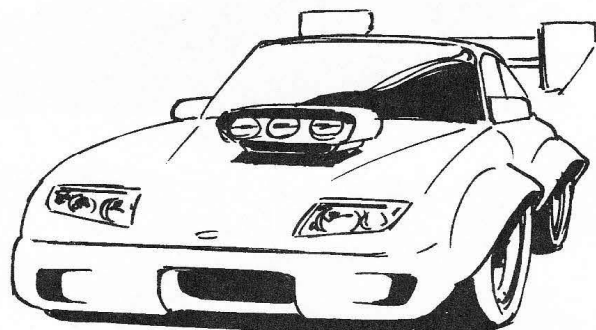
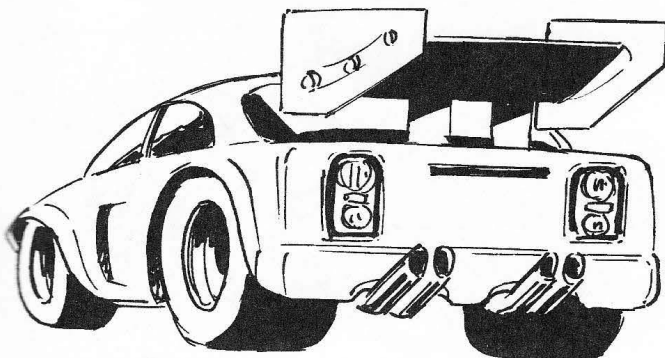


**Slick Tire**  
(Tire without tread designed for racing)



**Muffler**  
(Exhaust pipe)

Adding these parts to a typical car, results in...



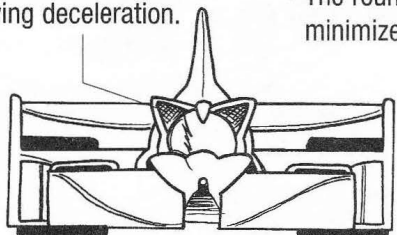
Merely the addition of these parts to a common sports car transforms it into a muscle car.

## Designing a Fast Car: A Form That Really Flies

There is a host of car types tailored to various purposes. Here, we limit our purposes to the car's drive and devote our attentions toward designing a fast car.

### Reverse Thrust Nozzle

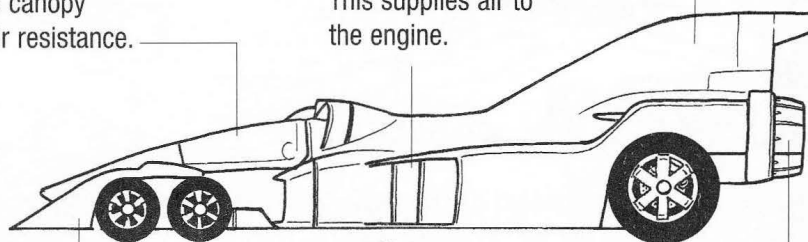
This system directs the engine's thrust forward, allowing deceleration.



Front

### Jet Plane Cockpit-Style Canopy (Windshield)

The rounded canopy minimizes air resistance.



Side

### Rear Wing

A vertical stabilizer designed to ensure balance when moving forward

### Air Intakes

This supplies air to the engine.

### Front Spoiler

This is designed to minimize air resistance on the car body and wheels.

### Car Body Form

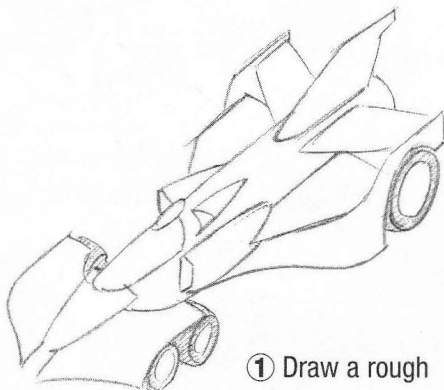
The wedge-shaped body is designed to enhance speed by slicing through the wind and moving forward as well as uses down force to allow the car to maintain balance while driving.

The large rear tires are indispensable to a fast car.

### Jet Engine

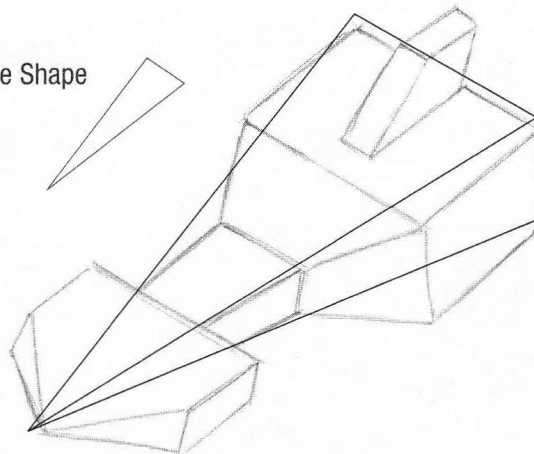
Allows for explosive acceleration

## Drawing an Original Concept Car

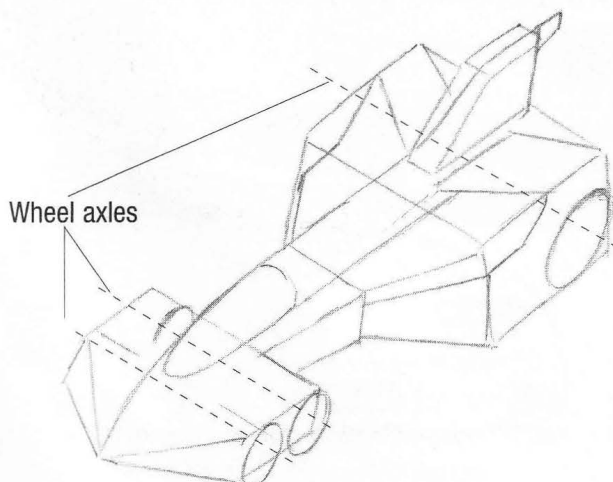


① Draw a rough reference image.

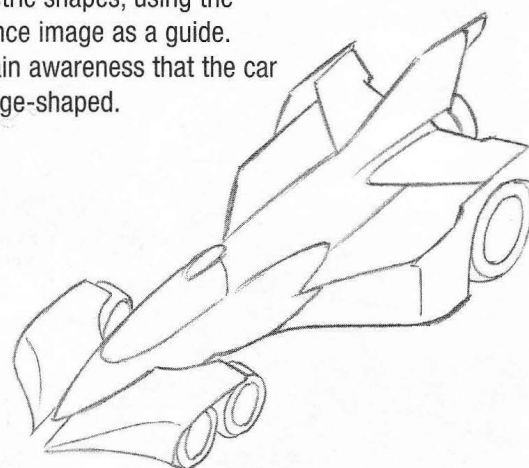
### Wedge Shape



② Build a base image of simple geometric shapes, using the reference image as a guide. Maintain awareness that the car is wedge-shaped.

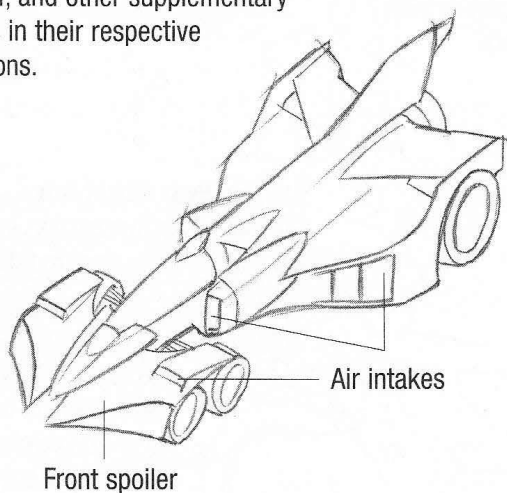


③ Draw the axles and position the wheels. Large rear wheels emphasize speed.

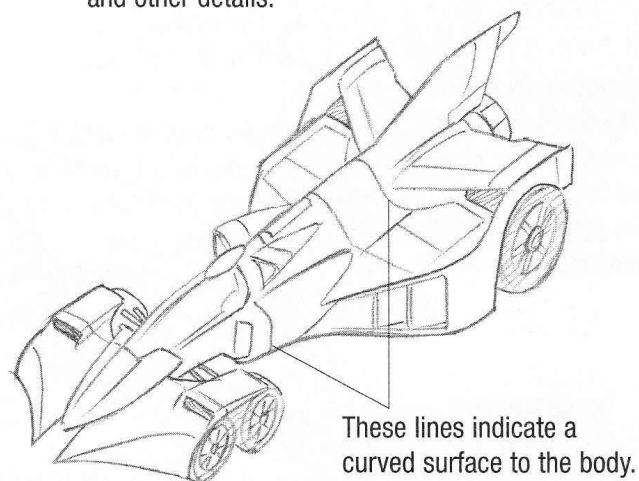


④ Adjust the form, rounding off sharp corners and edges.

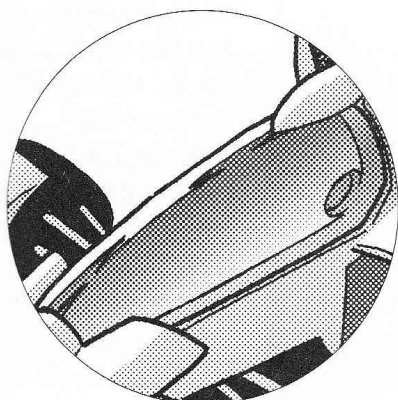
⑤ Place the air intakes, front spoiler, and other supplementary points in their respective positions.



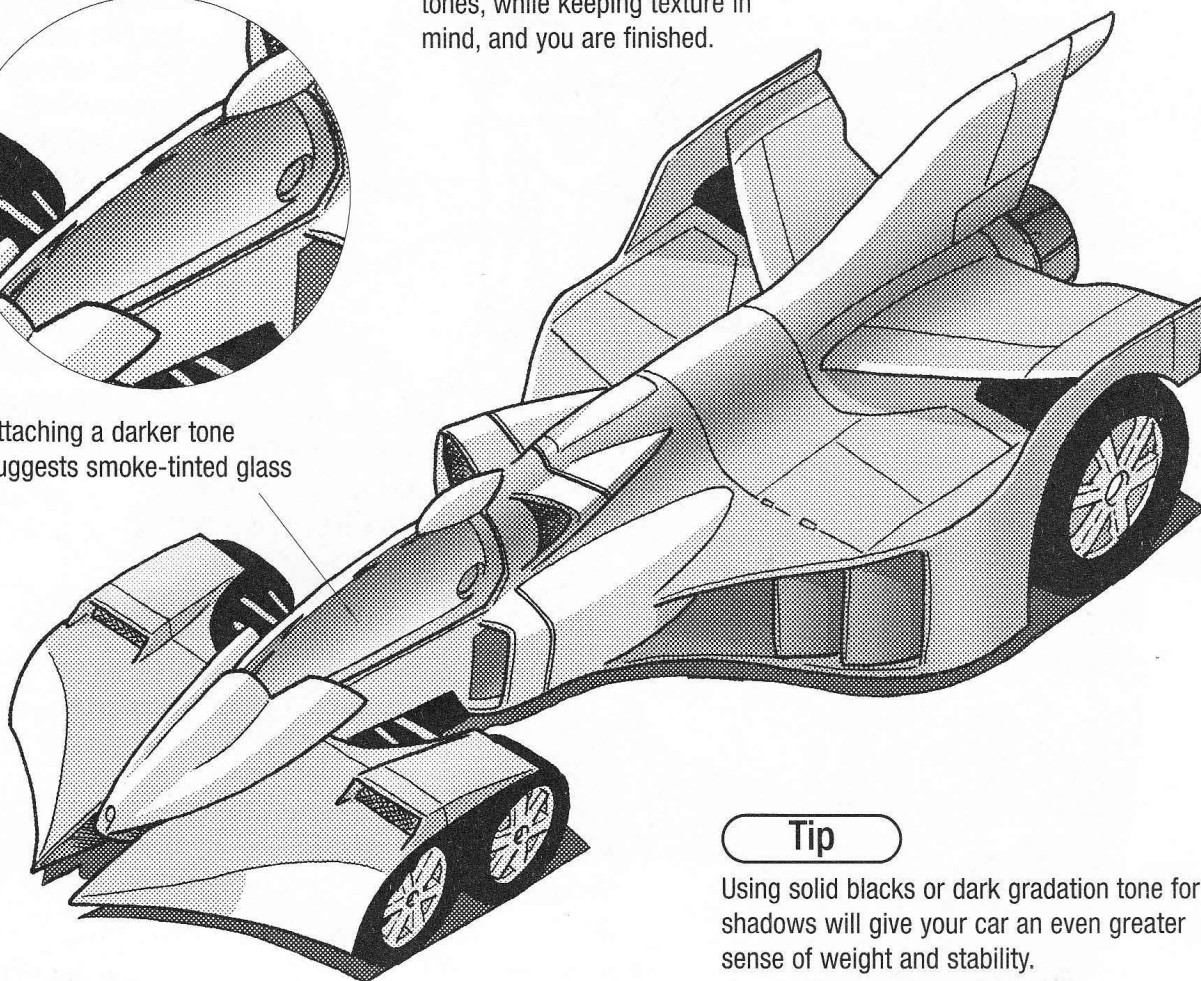
⑥ Add in lines to define the body and other details.



⑦ Spot blacks and apply screen tones, while keeping texture in mind, and you are finished.



Attaching a darker tone suggests smoke-tinted glass



### Tip

Using solid blacks or dark gradation tone for shadows will give your car an even greater sense of weight and stability.

Note: Smoke-tinted glass is a bluish-grey glass used on the windshield to block some of the sun's brightness.



## Designing a Fast Motorcycle: Imagining the Smooth Ride of a Luxury Car

Next, we will attempt to design an ultramodern, luxury sports motorcycle with overall rounded form, designed to ensure speed, coupled with a soft suspension.

### Cantilever fork

The fork supports the wheel on one side in a construction known as "cantilevering." Providing support on only one side lightens the motorcycle.

### Brake System

This features the same brake system as that of a car.

### Windshield

The windshield protects the driver from the wind and ensures an expansive view for safe driving. The rounded forms allow for reduced air resistance.

There is no fork on this side.

The fork supports the wheels, connected them to the motorcycle. Here, a plastic shield covers the fork.

### Internal Rear Wheel Drive

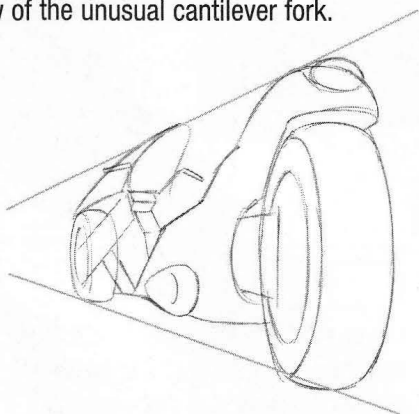
The one-point suspension means a light, luxuriously smooth ride.

The seat positions the rider's body to follow the motorcycle's contours, meaning that the rider will not tire even over long distances.

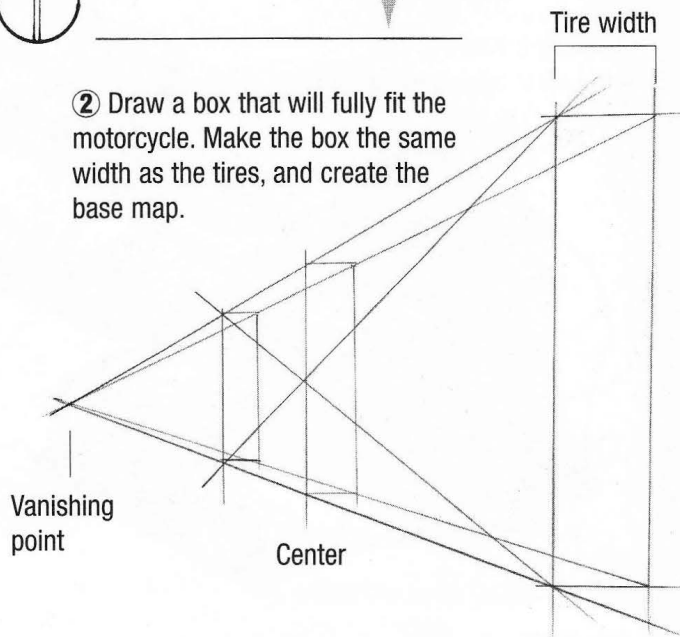
### Minimal Height

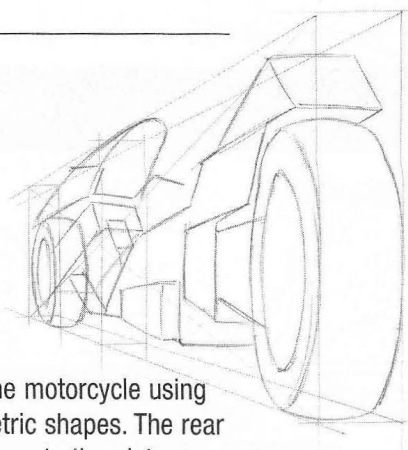
This bike is low to the ground, reducing air resistance and improving balance and ensuring a stable ride, owing to the low center of gravity.

① Imagining a scene where our motorcycle passes another vehicle, this scene was composed from a rear perspective. The composition is from the left, ensuring full view of the unusual cantilever fork.

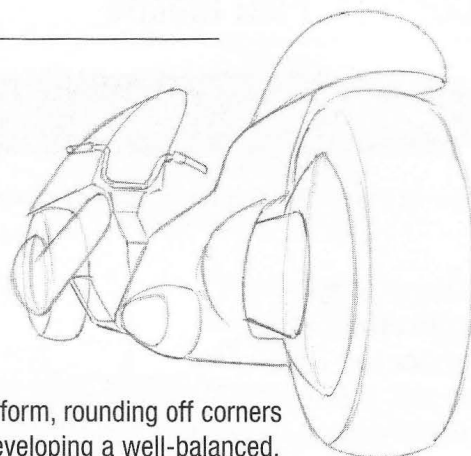


② Draw a box that will fully fit the motorcycle. Make the box the same width as the tires, and create the base map.

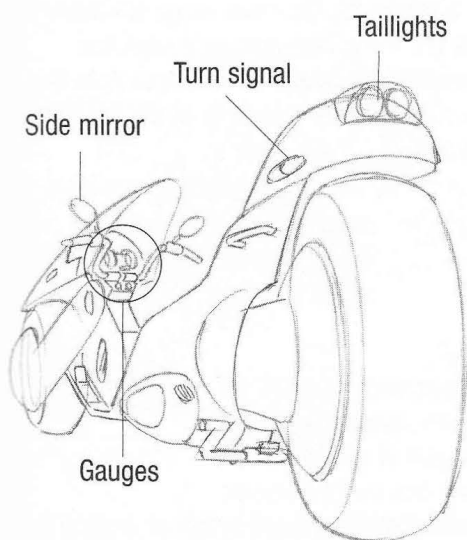




③ Build up the motorcycle using simple geometric shapes. The rear wheel lying close to the picture plane constitutes the focus of this perspective-exploiting composition.



④ Adjust the form, rounding off corners and edges. Developing a well-balanced, rounded form will allow to create an ultramodern image with beautiful, flowing lines.

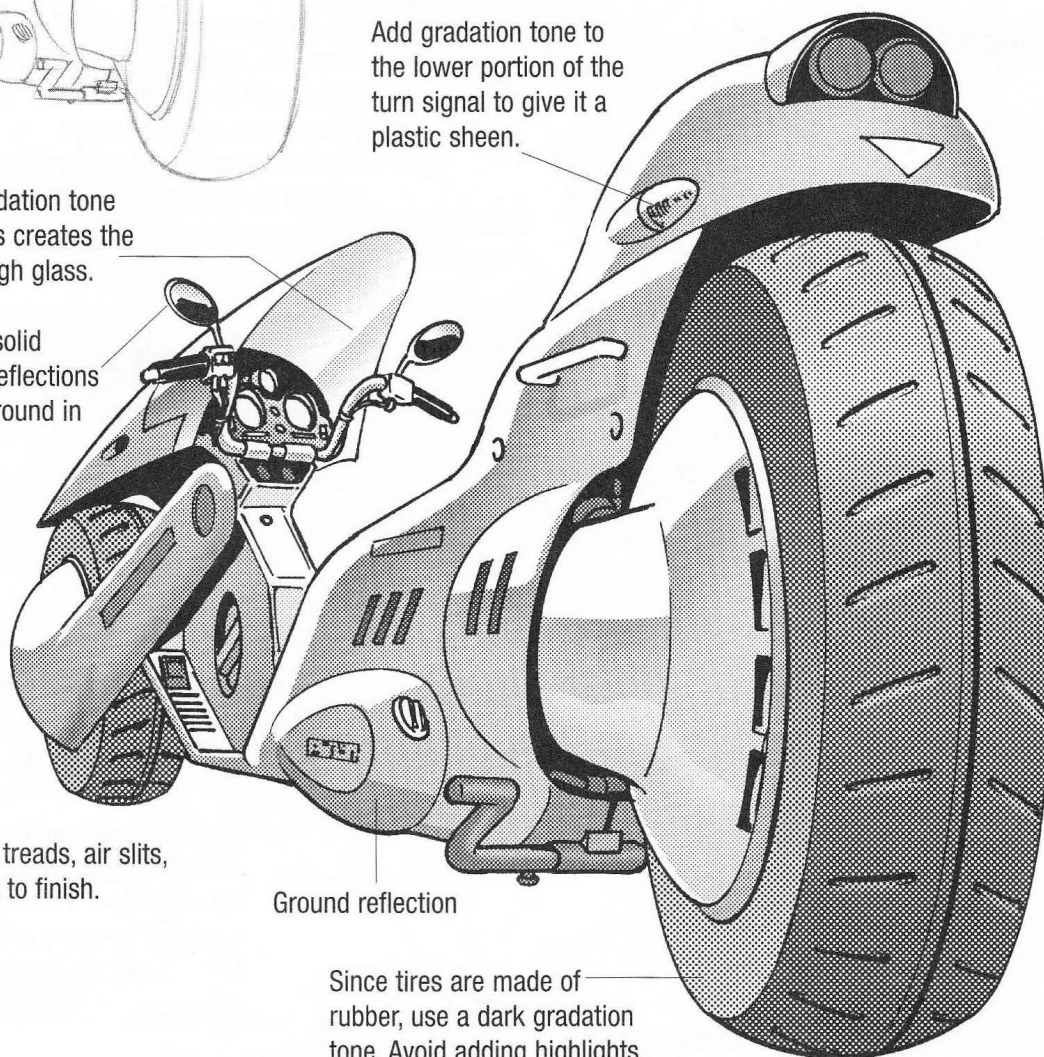


⑤ Add the taillights, turn signal, side mirrors, and other necessary supplementary parts. The gauges are a key element adding to the image's "mecha" qualities.

Using a light gradation tone to add reflections creates the feel of see-through glass.

Plain white and solid blacks suggest reflections of the sky and ground in the side mirror.

Add gradation tone to the lower portion of the turn signal to give it a plastic sheen.



⑥ Draw the tire treads, air slits, and other details to finish.

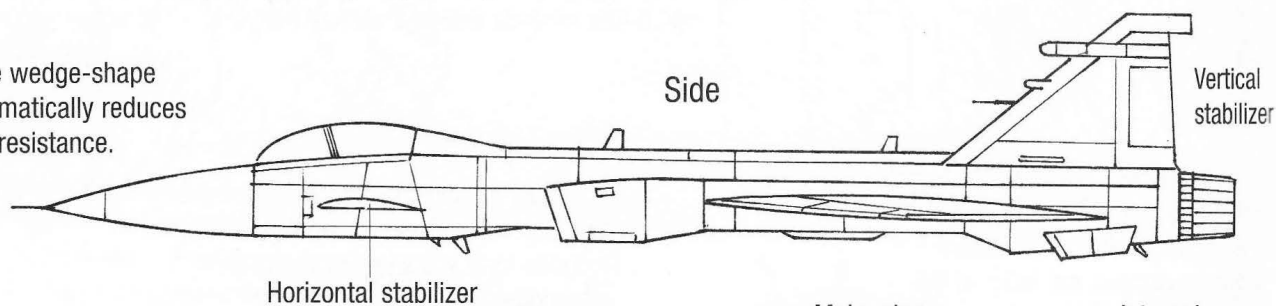
Ground reflection

Since tires are made of rubber, use a dark gradation tone. Avoid adding highlights.

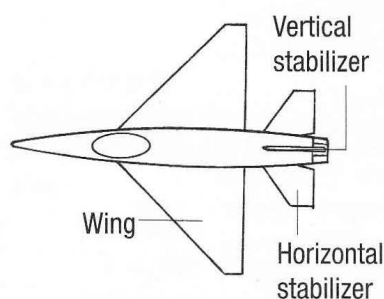
## Designing a Supersonic Jet: Reversing Concepts to Design Ultra Fast Forms

Now let's try drawing a super fast jet by turning around the main wings and tail.

The wedge-shape dramatically reduces air resistance.

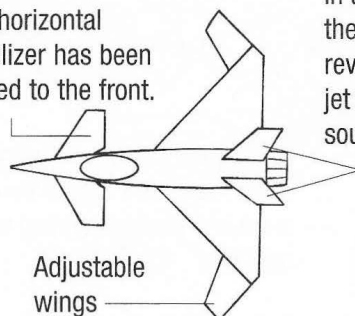


### Typical jet



### Reversed jet

The horizontal stabilizer has been moved to the front.

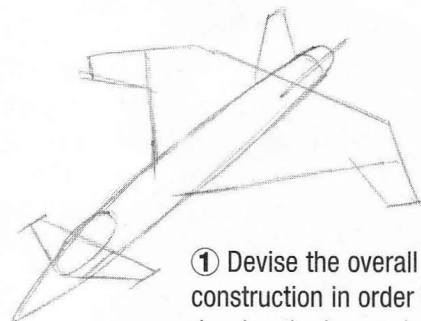


The tips of the main wings are adjustable, allowing for control over lifting power.

In a typical jet, the main wings are larger than the tail. Here, I focused on design and reversed this relationship. Please note that the jet must also be able to fly at the speed of sound.

The vertical stabilizer has been doubled. This helps balance the jet when traveling at the speed of sound.

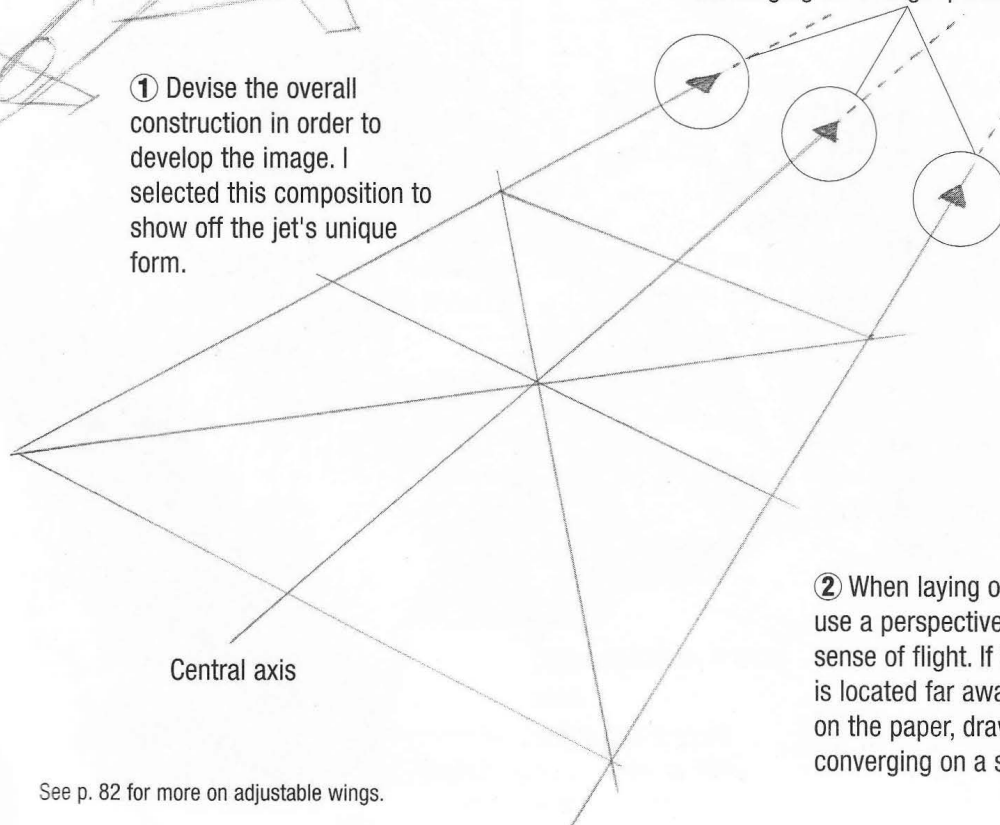
### Drawing an Original Jet



① Devise the overall construction in order to develop the image. I selected this composition to show off the jet's unique form.

Horizon — Distant vanishing point

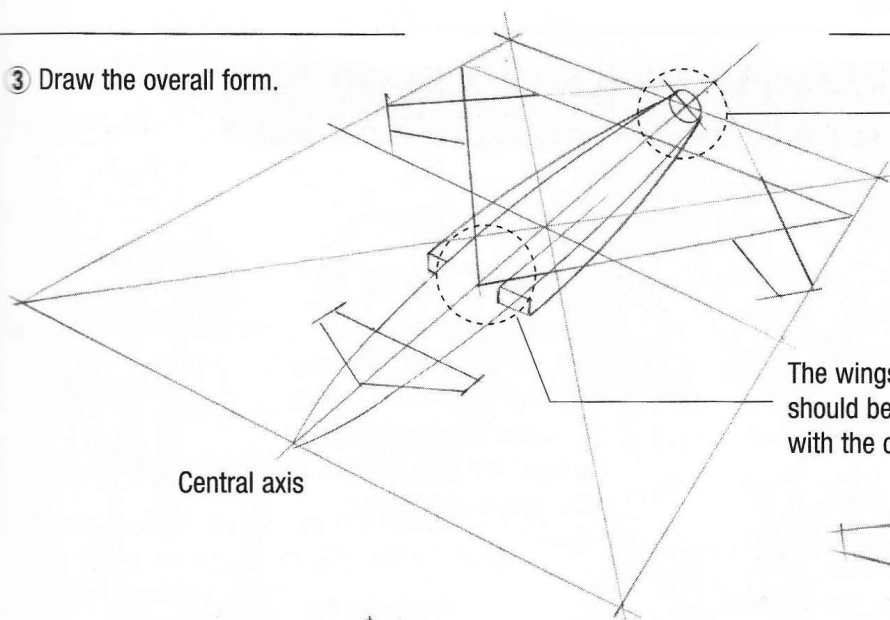
When the vanishing point is distant making it difficult to fit on the paper, draw lines as if converging on a single point.



② When laying out the base map, use a perspective that will create a sense of flight. If the vanishing point is located far away and does not fit on the paper, draw lines as if converging on a single point.

See p. 82 for more on adjustable wings.

③ Draw the overall form.



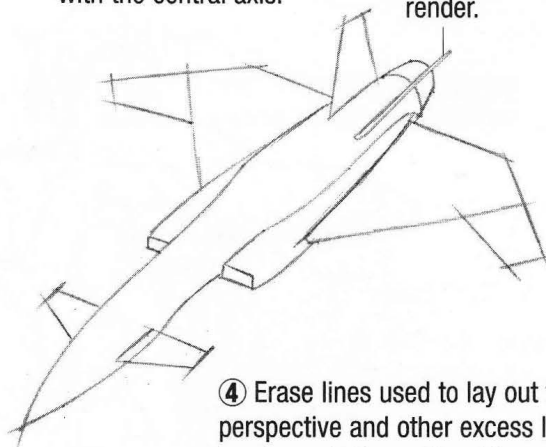
Close-up View

Center

The point where three lines converge becomes the center of a circle.

Take care: this angle is difficult to render.

The wings' vertex should be aligned with the central axis.

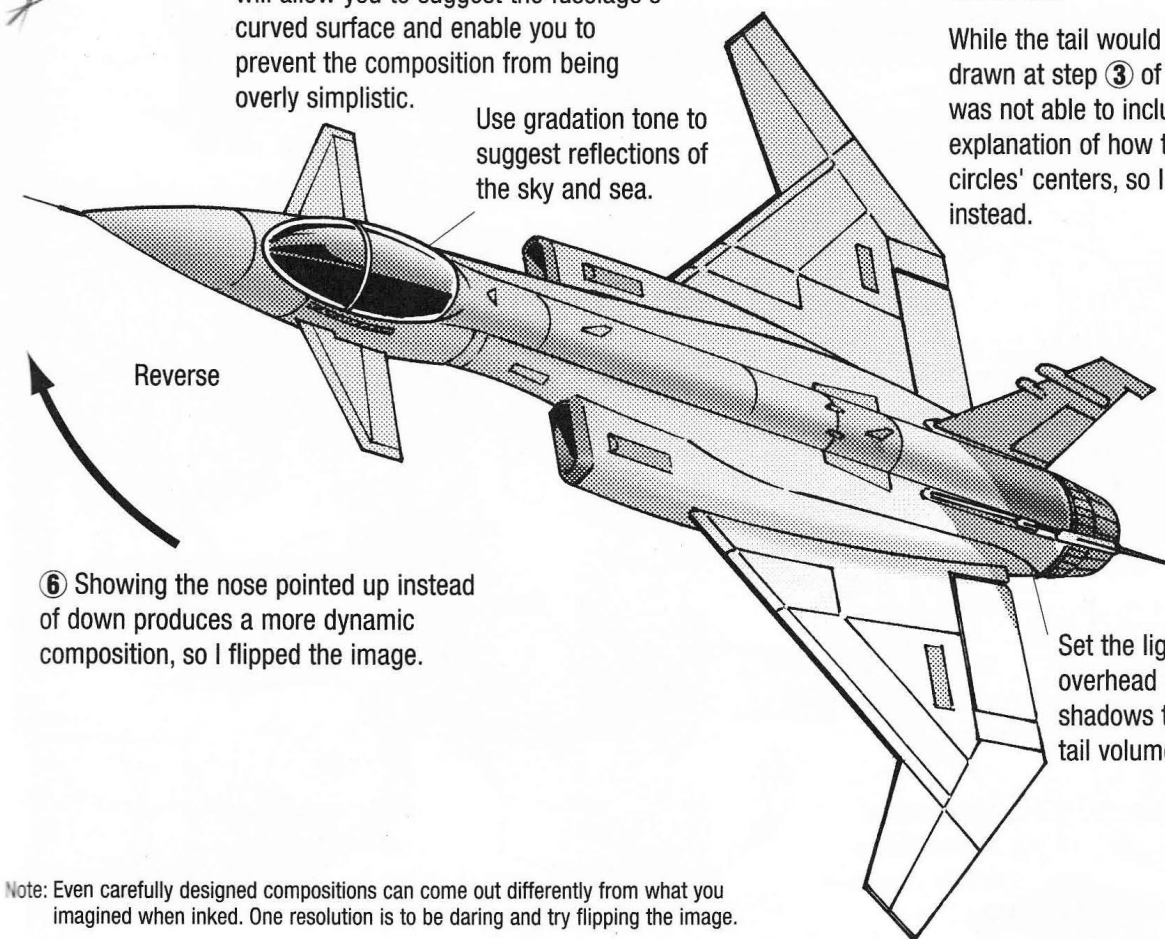


④ Erase lines used to lay out the perspective and other excess lines, leaving only the outline. The angle of the right vertical stabilizer in this composition is very difficult, so take extra care.

While the tail would normally be drawn at step ③ of the process, I was not able to include it with the explanation of how to find the circles' centers, so I added it here instead.

⑤ Draw the canopy, lines connecting steel body plates, etc. Adding these lines will allow you to suggest the fuselage's curved surface and enable you to prevent the composition from being overly simplistic.

Use gradation tone to suggest reflections of the sky and sea.



⑥ Showing the nose pointed up instead of down produces a more dynamic composition, so I flipped the image.

Set the light source overhead and add shadows to give the tail volume.

Note: Even carefully designed compositions can come out differently from what you imagined when inked. One resolution is to be daring and try flipping the image.

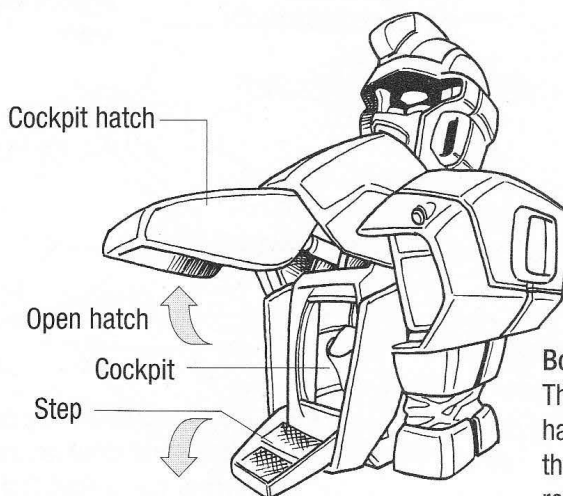


## Using Shifting Concepts to Develop Combat Robots

While there is a myriad of automaton types, here we will try to design a combat robot that exceeds the structure and function of everyday machines.

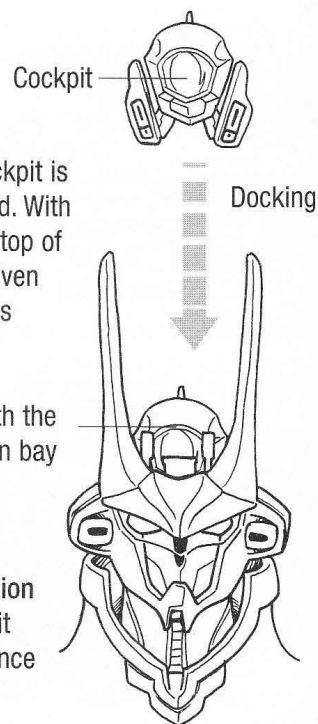
### Two Types of Piloted Robots

Design a robot that is boarded and steered by a pilot.



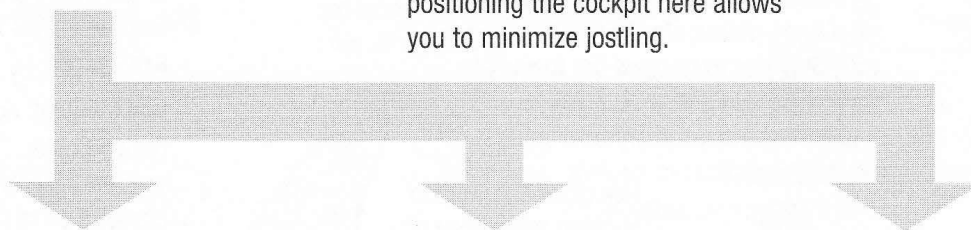
#### Boarding at the Head

Here, the detached cockpit is "docking" into the head. With the cockpit located on top of the head, the pilot is given command of the robot's "vision."

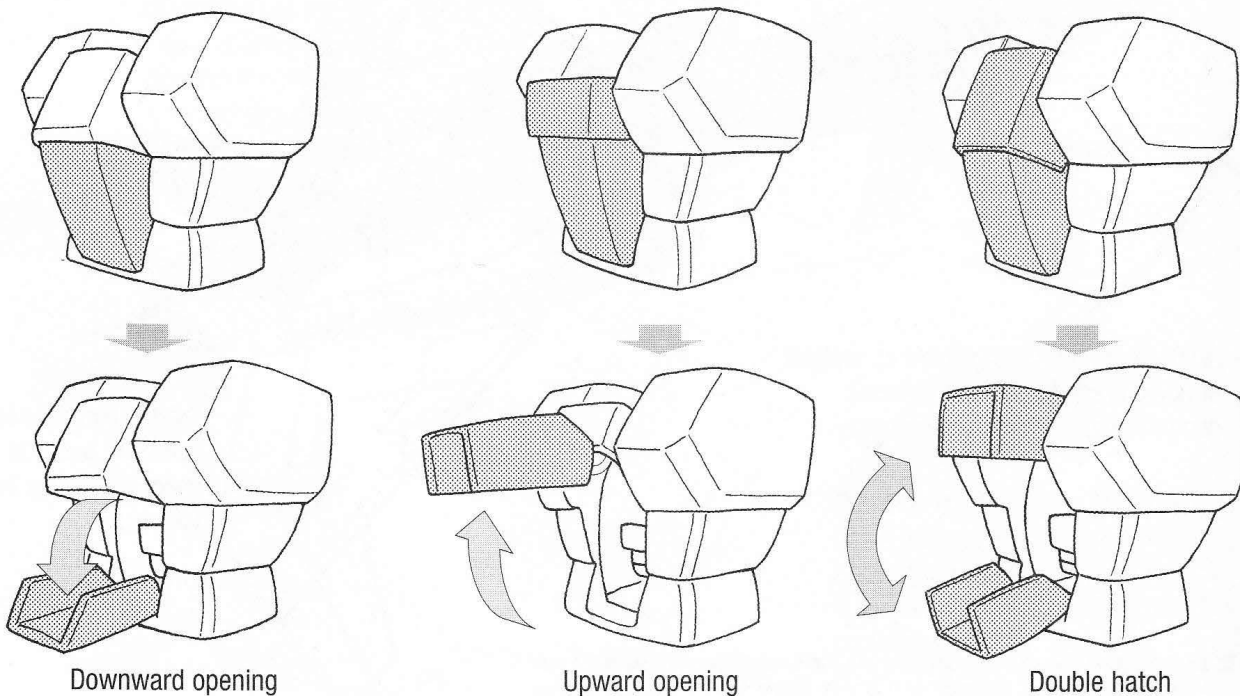


#### Boarding at the Abdominal Region

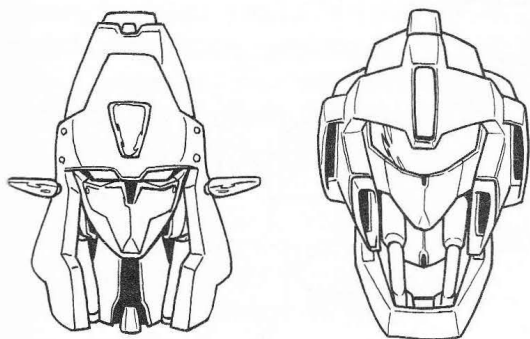
The pilot boards via open cockpit hatch doors located ventrally. Since the robot's center ("abdominal" region) does not move much, positioning the cockpit here allows you to minimize jostling.



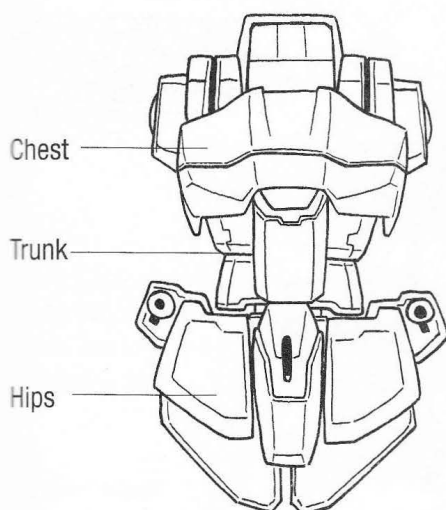
### Cockpit Hatch Shapes



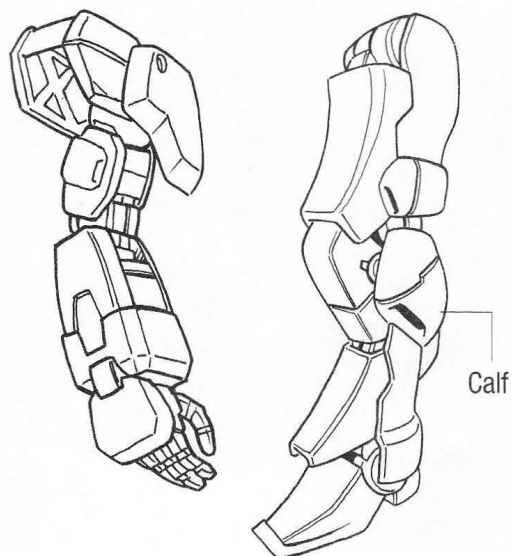
## Heroes



Heads that are reminiscent of a human face give the viewer a sense of security and are suited toward good guy robots.



Slender body design



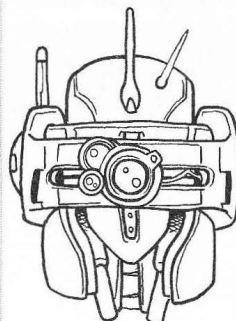
The calf swells in the same manner as that of a human.

## Head

## Abdomen and Hips

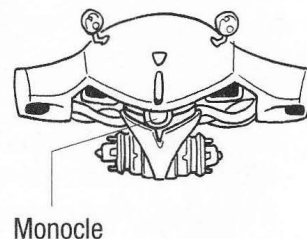
## Arms and Legs

## Villains

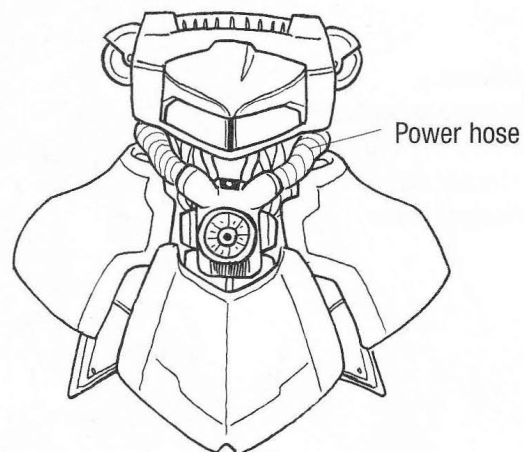


Asymmetrical head

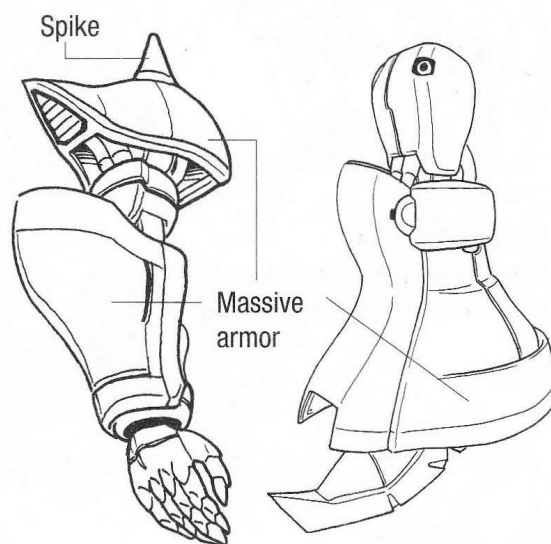
The asymmetrical head and single eye give the viewer a sense of unease, making them suited for evil robots.



Monocle



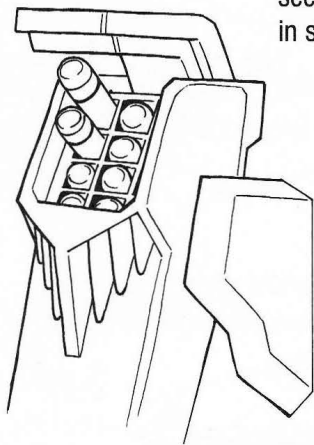
The stout build projects a hulking, intimidating presence.



To give a frightening air, attach spikes, etc. to massive pieces of armor.

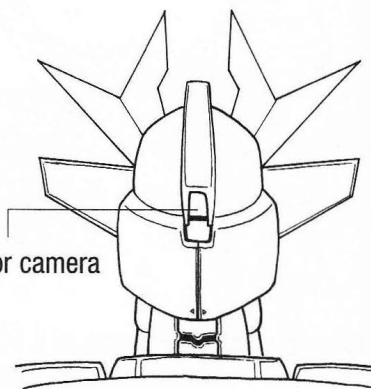
## Hero Robots: Roundness within Sharp Edges

Viewers sympathize with and feel comfortable about human-shaped automatons that are basically symmetrical. Sharp forms feel crisp and refreshing, seem just, and subtle. Robots reminiscent of knights in shining armor make ideal heroes.



### Pauldron

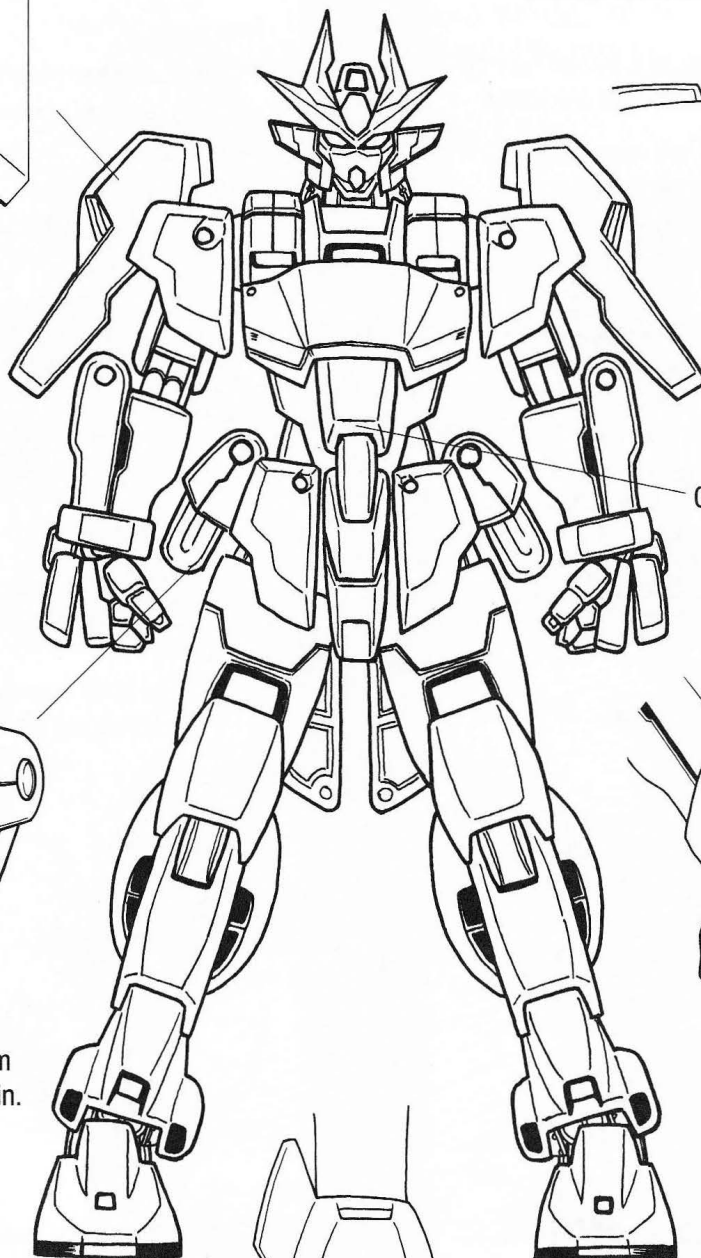
The enlarged armor protects the body. Missiles and other weapons are contained within.



Monitor camera

### Rear of head

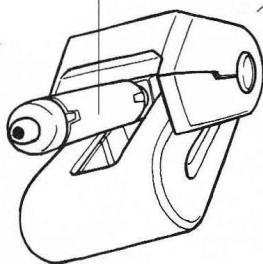
The rear of the head is installed with a camera to ensure monitoring.



Cockpit

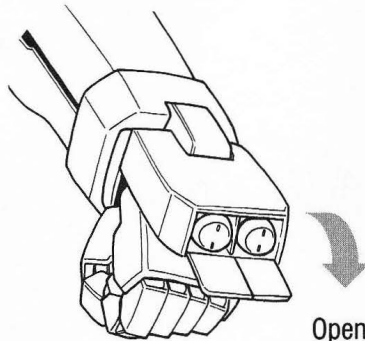
Beam saber

Open



### Fauld (side armor)

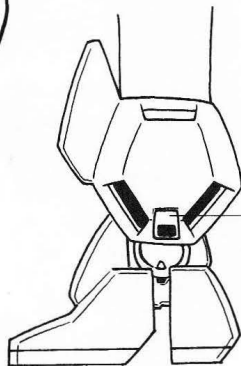
Sub-thrusters and a beam saber are contained within.



Open

### Arm missiles

The arm is equipped with missiles to allow for easy aim.



### Sub-thrusters

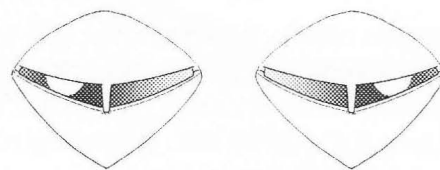
(Auxiliary propulsion devices)

Sub-thrusters, used to assist jumping over terrain and for propulsion in space, are installed in the legharness.

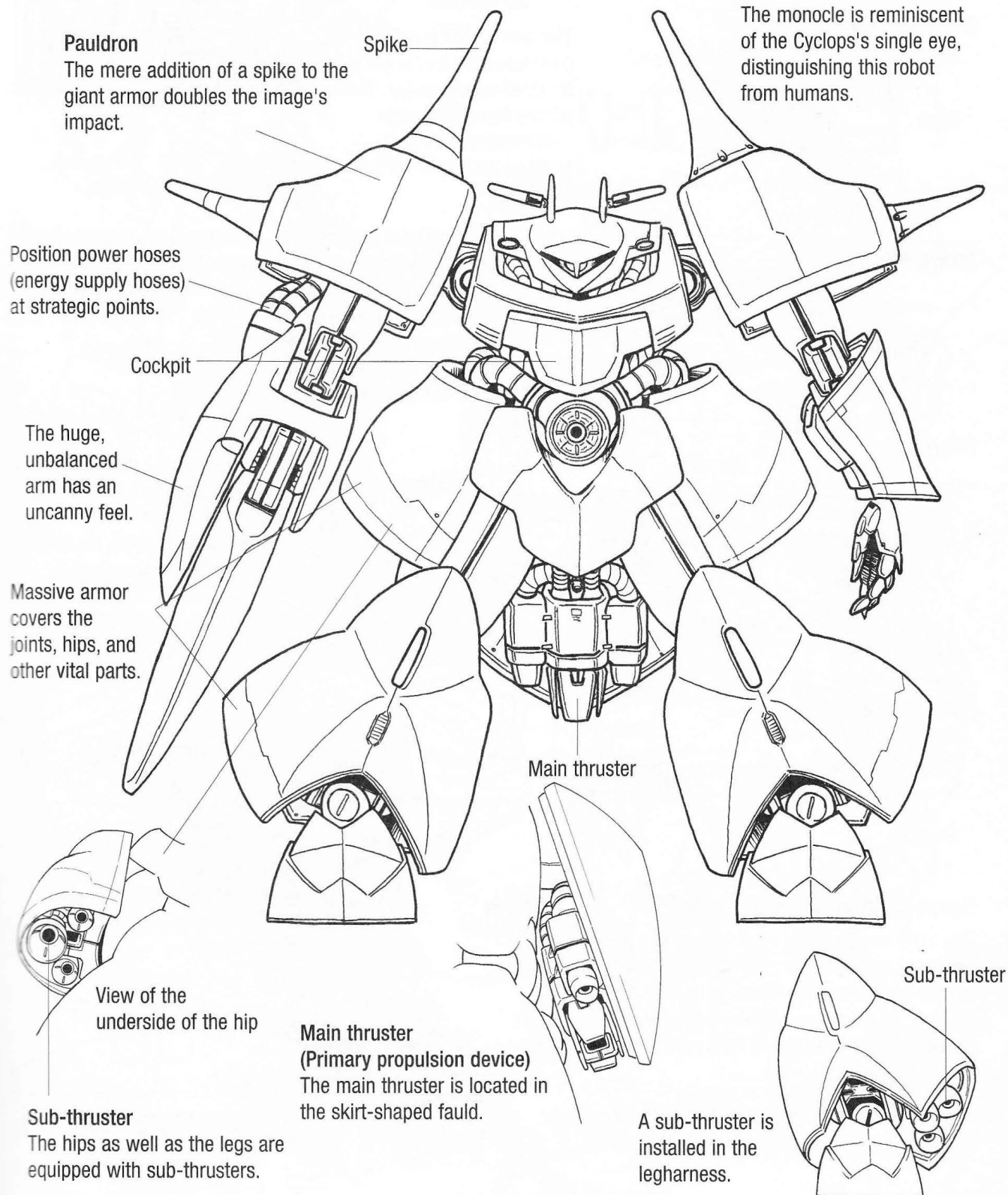
## Villains: Sharpness within Round Forms

Asymmetry gives the viewer feelings of discomfort and unease. In addition, a round, heavyset, gigantic body projects a threatening, menacing air. The more the robot's form departs from that of a human, the more frightening and despicable it seems.

Right and left shifting monacle



The monacle is reminiscent of the Cyclops's single eye, distinguishing this robot from humans.



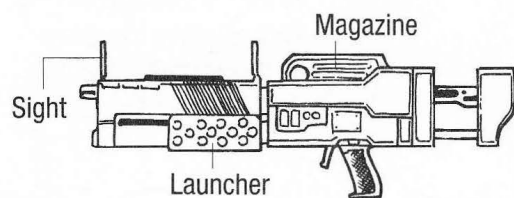
**Note:** Needless to say, villains and heroes are given contrasting forms to set a distinction between the two and to double the sense of invigoration felt when the hero wins. Since the villain must ultimately be vanquished, make him as huge, scary, and strong looking as possible.



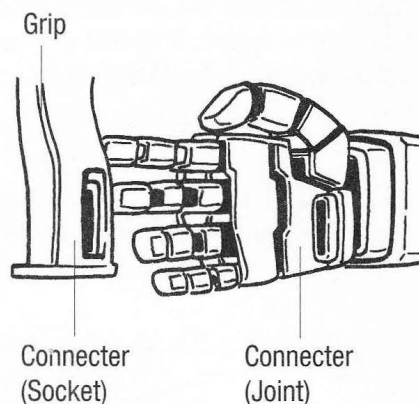
## Designing Slick Weapons for Robots

Weapons come in various forms ranging from small machine guns to huge cannons. They are used according to purpose and intent. The trick is to use audacious ideas in your designs, such as combining two types of guns or to drawing them at incredibly enormous sizes.

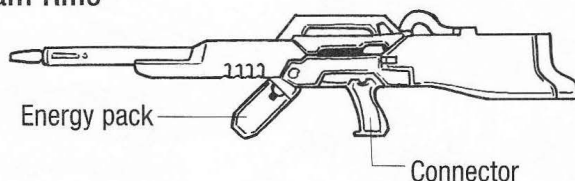
### Machine Gun



This gun is able to deliver continuous fire and is suited for close-range combat. The missile launcher located underneath allows for targeted destruction of the enemy.



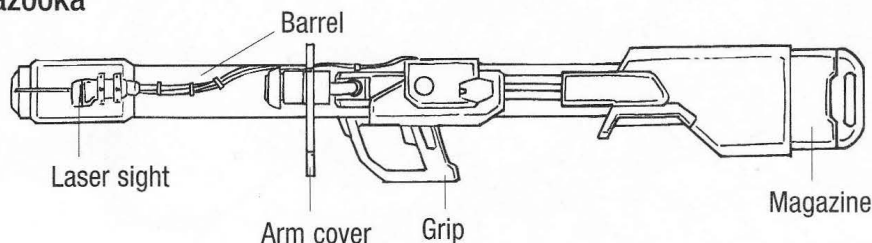
### Beam Rifle



This gun uses an energy pack to fire laser pulses. It has accurate firing capability, so it is used by snipers or for intermediate-range fighting. The energy pack itself composes the grip.

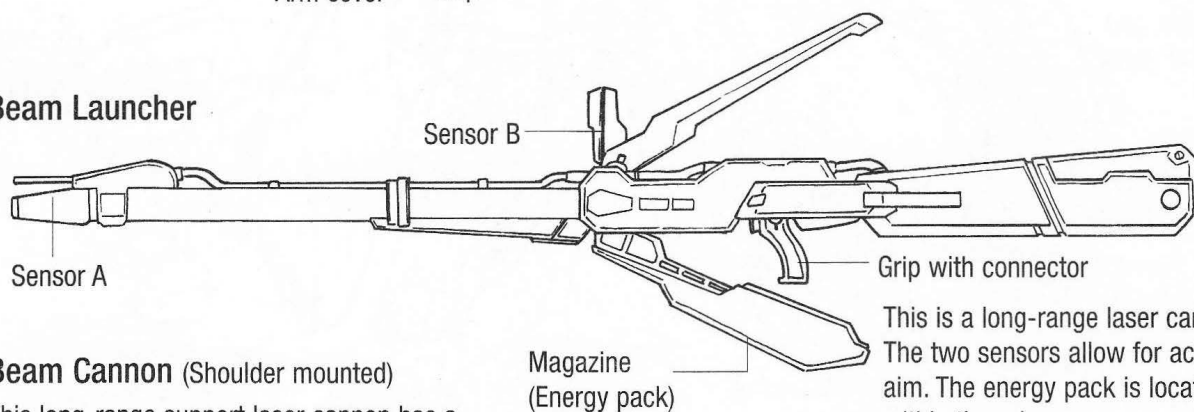
Energy is dispatched upon connection of the joint connector in the wrist to the socket connector on the grip.

### Bazooka



The bazooka is a rocket launcher, primarily used for guerrilla and terrorist activities. Lengthening the barrel and adding the laser sight enhances accuracy.

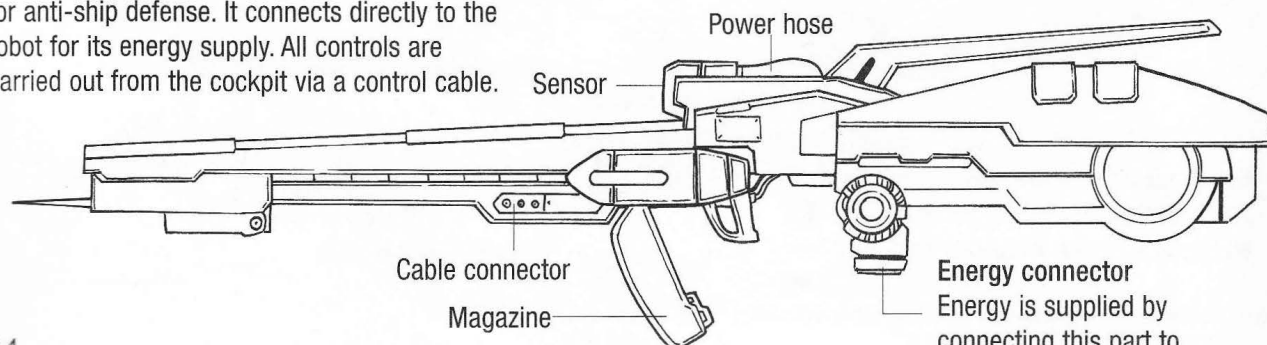
### Beam Launcher



This is a long-range laser cannon. The two sensors allow for accurate aim. The energy pack is located within the grip.

### Beam Cannon (Shoulder mounted)

This long-range support laser cannon has a tremendous destructive capacity and is used for anti-ship defense. It connects directly to the robot for its energy supply. All controls are carried out from the cockpit via a control cable.



Energy is supplied by connecting this part to the robot's shoulder.

Rapid fire trajectory

Machine gun

Beam cannon

The control cable allows for the cannon to be operated from the cockpit.

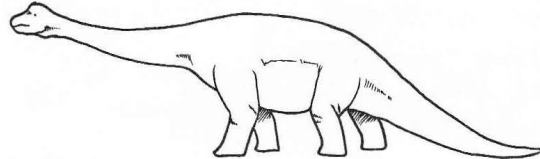
Increase the image's impact by equipping your robot with a mammoth weapon.

## Designing Animal Mechas: Animal-shaped Combat Robots

### Designing a Tank-Robot from a Dinosaur

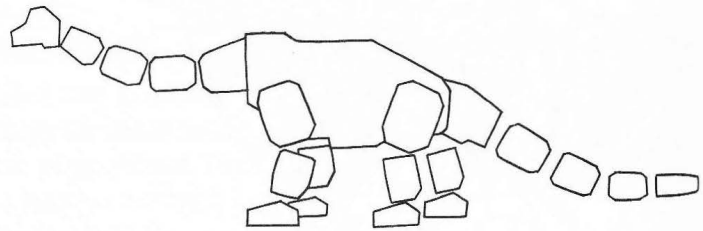
Now we will look at designing a massive tank-like combat robot derived from a giant long-necked dinosaur's form.

Reference Dinosaur



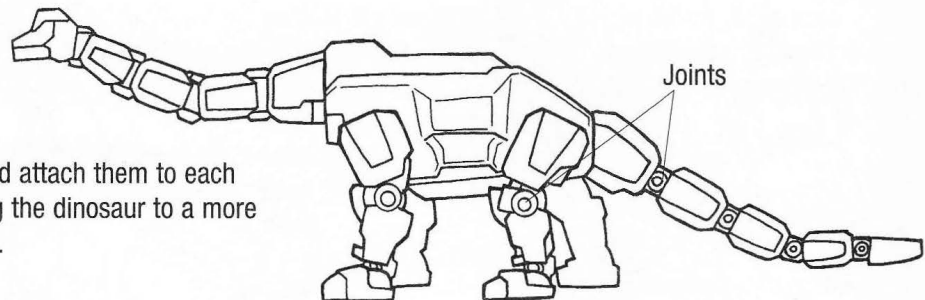
#### Plesiosaurus

A giant, long-necked herbivore measuring up to 30 m. (97 1/2') in length



① Build the neck and tail using blocks, creating an easily maneuverable construction.

② Add in joints and attach them to each block, transforming the dinosaur to a more "mecha-like" form.



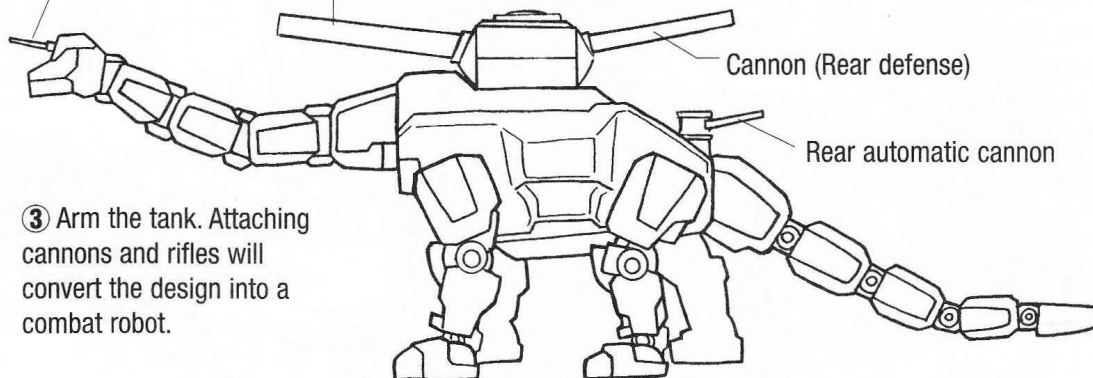
Forward automatic cannon

Cannon (Front defense)

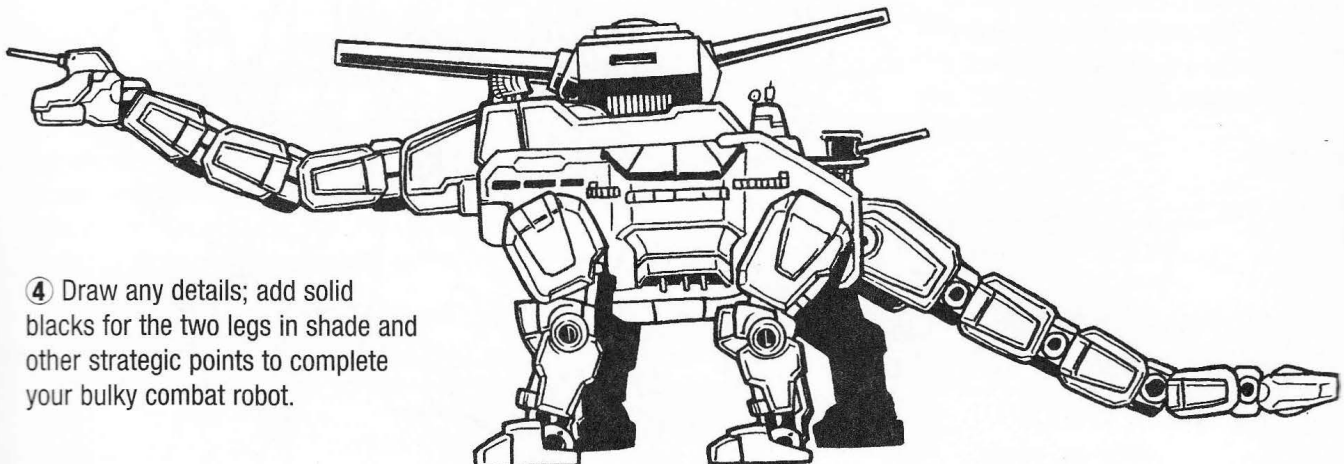
Cannon (Rear defense)

Rear automatic cannon

③ Arm the tank. Attaching cannons and rifles will convert the design into a combat robot.



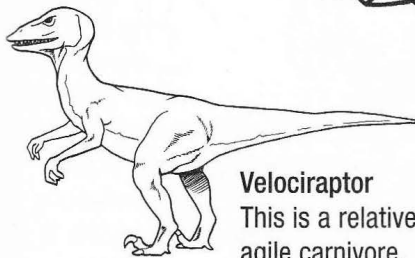
④ Draw any details; add solid blacks for the two legs in shade and other strategic points to complete your bulky combat robot.



## Designing a Swift Attack Robot

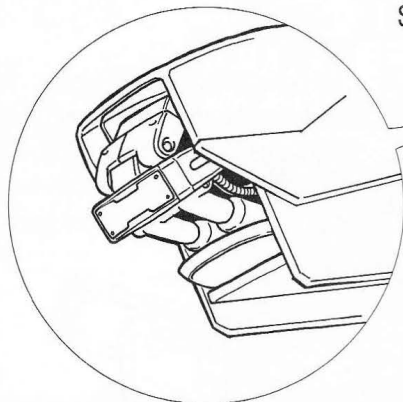
Now we will create an agile attack robot, incorporating the nimble movements of a velociraptor.

### Reference Dinosaur



#### Velociraptor

This is a relatively small, agile carnivore.



Sensor

Adding cylinders and shock absorbers to the joints boosts the sense of authenticity.



Shock Absorber

The nimble legs, capable of racing around hostile territory are a key feature.

The tail serves to balance the robot when running and functions as a vertical rudder.

Cannons

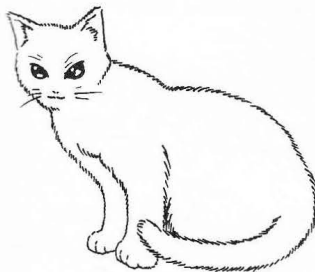
Claws

## Pet-shaped Security Robot: Cat

### Reference Animal

#### House Cat

This small, nocturnal carnivore possesses superior hunting abilities within a cuddly body.



#### Face

A red light flashes in warning upon detecting an intruder.

Sharp claws used to attack the intruder

Speaker  
Sounds warning

Sensors  
Detect suspicious sounds

Tail delivers electric shocks.

Legs  
Nimble legs coupled with extraordinary jumping ability bring the intruder to bay.

Note: A cat automaton would seem ideal for night patrol. The robot could be powered using solar energy and recharged by placing it on a windowsill during the day, looking just like a napping house cat.

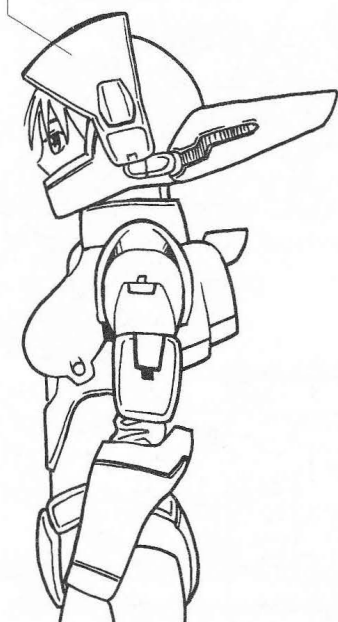


## Designing Futuristic Battle Suits

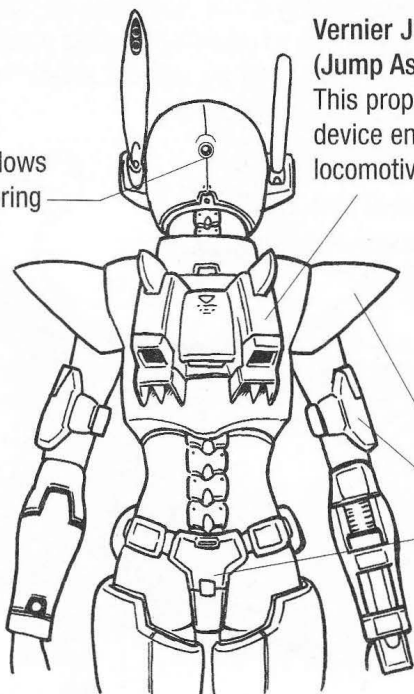
Battle suits are protective gear designed to shield the wearer from enemy attack. The suits are also equipped for attack.

### Visor

This shields the face and contains a monitor. Upon lowering the visor, an image projected from a camera is reflected inside.



The back camera allows for monitoring the rear.



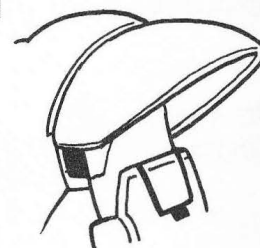
### Standard Infantry Soldier

This soldier is geared toward close-range or indoor combat. She is not equipped with heavy weaponry. She is capable of fighting in confined spaces.



### Shoulder Pad

The oversized shoulder pad facilitates movement.

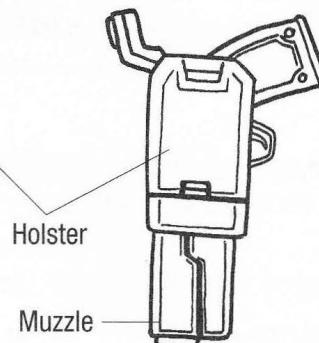


### GPS Antenna

This antenna receives satellite transmissions, allowing the soldier to verify her position.

### Holster

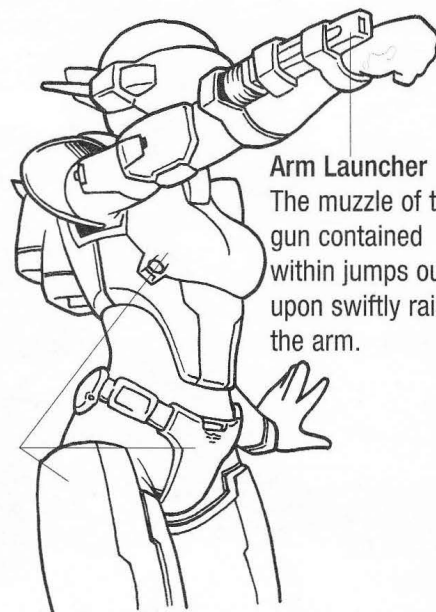
The hole at the holster's base exposing the muzzle allows for firing in emergency situations when the gun cannot be drawn. It also serves as a recharger for the laser gun.



### Vernier Jet (Jump Assist)

This propulsion device enhances locomotive ability.

Protective plating designed to shield the joints and other vital parts.

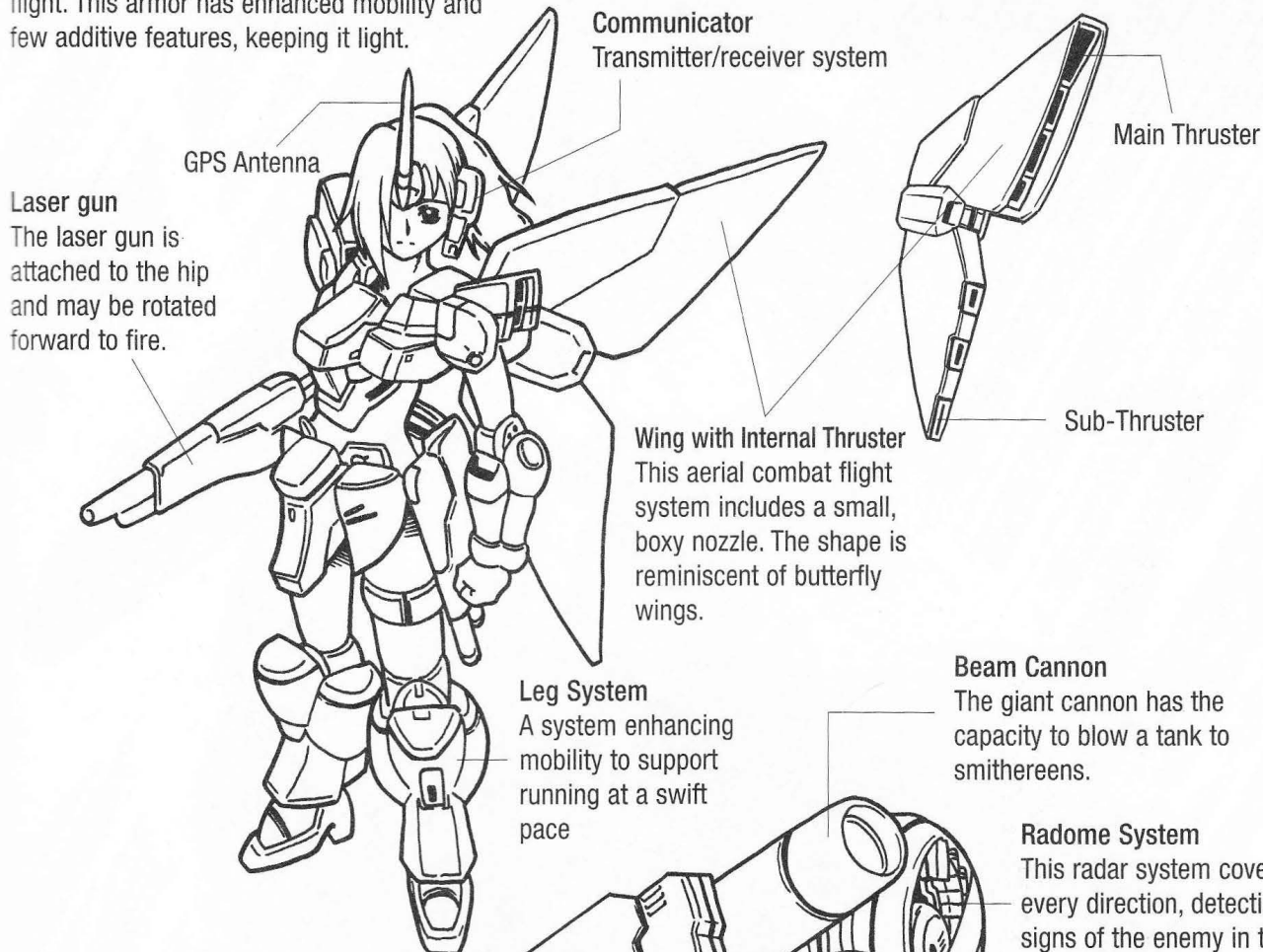


### Arm Launcher

The muzzle of the gun contained within jumps out upon swiftly raising the arm.

## Lightweight, Aerial Combat Armor

Thrusters contained within the wings enable flight. This armor has enhanced mobility and few additive features, keeping it light.



GPS Antenna

### Laser gun

The laser gun is attached to the hip and may be rotated forward to fire.

Communicator  
Transmitter/receiver system

Main Thruster

Sub-Thruster

**Wing with Internal Thruster**  
This aerial combat flight system includes a small, boxy nozzle. The shape is reminiscent of butterfly wings.

**Leg System**  
A system enhancing mobility to support running at a swift pace

### Beam Cannon

The giant cannon has the capacity to blow a tank to smithereens.

### Radome System

This radar system covers every direction, detecting signs of the enemy in three dimensions.

### Monitor

The chest-mounted monitor displays all sorts of information, including laser and cannon sights.

## Anti-Tank Armor

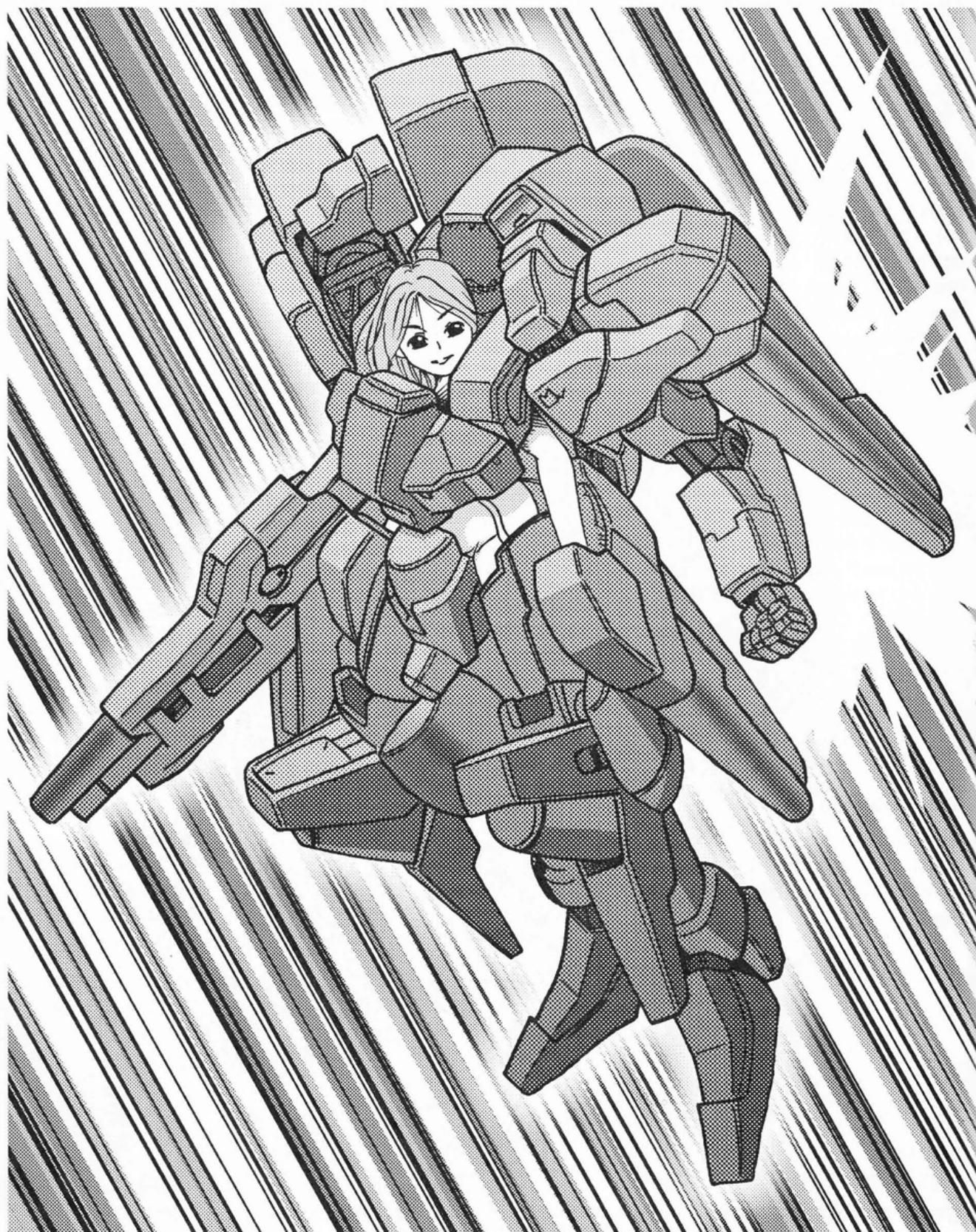
While this armor has less mobility, it does have the same destructive capacity as a tank.

**Propellant Tank**  
Enables long-range travel

Dressing a character in robotic armor or parts is a fun concept. Make abundant use of your imagination, and your design possibilities will be limitless.

The feet are equipped with caterpillar treads. Here, design was emphasized, so the treads are not visible from the exterior.

**Note:** This armor equips humans similarly to robots in order to provide protection. What about leaving the navel or arms exposed? Not a problem! Sometimes favoring design over function or logic makes for a more interesting image.



### Aerial Combat Armor

A girl flying dressed in aerial combat armor

Note: While the above armor is more robotic in flavor than a "battle suit" per se, it still is visually exciting.

You may use light screen tones for combat robot-like, heavy armor to create the light texture of reinforced plastic. Adding dark tone or shadows to strategic points results in a well-balanced composition.



# Chapter 5

## Tricks in Drawing Dynamic Mecha

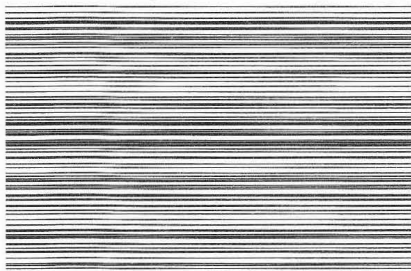




## Using Special Effects to Suggest Speed

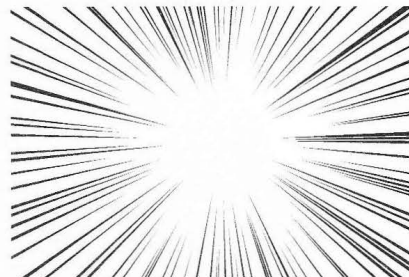
Once you have drawn your mecha, add special effects. Effects intended to show movement, such as speed lines (streak lines) or radiating lines are called "special effect lines." Speed lines suggest a right-to-left movement, while radiating lines (burst effect) suggest movement away from the picture plane, creating a sense of speed and tension, giving the composition impact.

### Speed Lines



Speed lines suggest a right-to-left or up-and-down movement.

### Radiating Lines

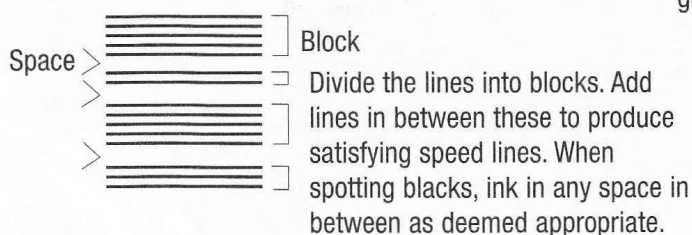
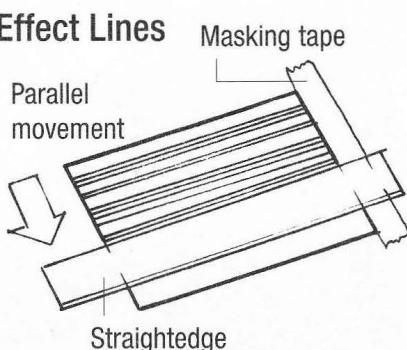


Radiating lines are geared toward suggesting movement toward or running away from the picture plane.

### Creating Special Effect Lines

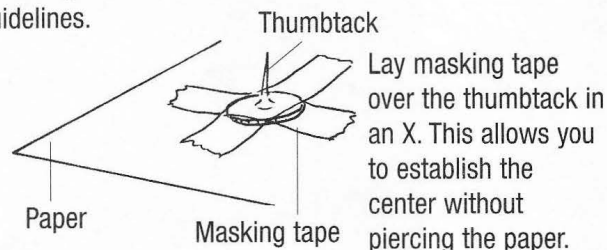
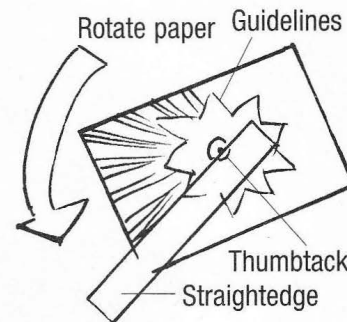
#### • Speed Lines

While drawing a straightedge downward across the paper, draw horizontal lines at random intervals. Use a stiff saji-pen, etc.

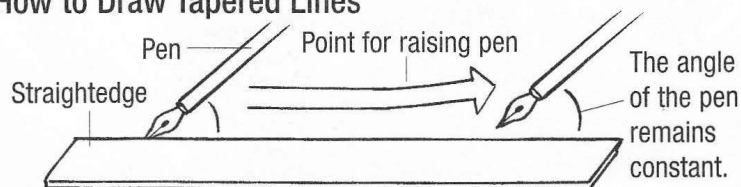


#### • Radiating Lines

Attach a thumbtack to the center. Using a straightedge set to the center and rotated around the paper, draw fading\*2 radiating lines, matching them with the guidelines.

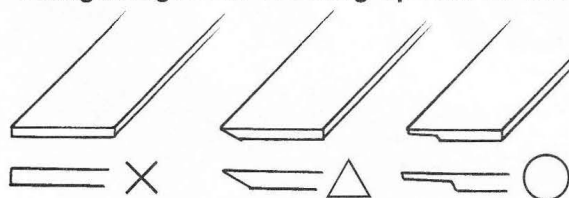


### How to Draw Tapered Lines



To create a well-formed, tapered stroke, hold the pen at a consistent angle, drawing it quickly in the direction in which you want the line to taper.

### Straightedges for Creating Special Effect Lines



Of the straightedges shown to the left, the one with the raised edge is best suited for special effect lines.

**Not good** ————— Even line  
**Good** ————— Tapered line

### Attention!

A flat-bottomed straightedge will cause the lines' ink to smudge and bleed under the straightedge. There is a danger you will not notice until your drawing has a jet-black smear on it, so be very careful.

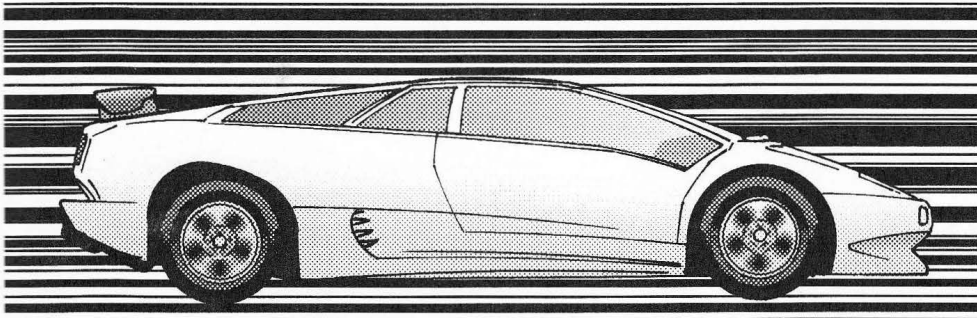
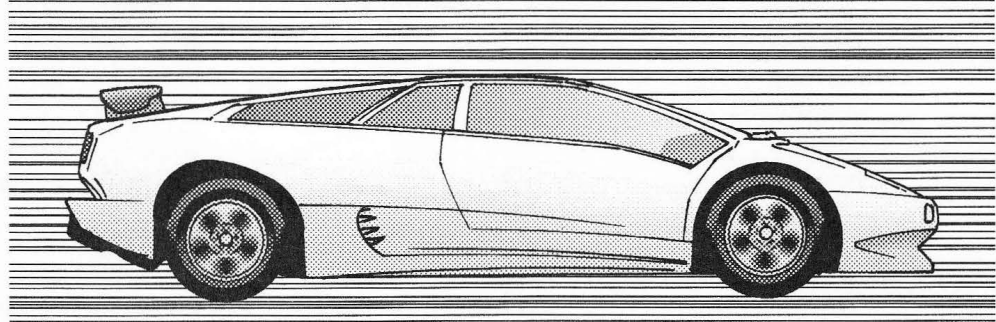


## ● Special Effect Line 1: Speed Lines

There are four common types of speed lines. They suggest right and left motion across the picture plane. The artist controls the sense of speed by the concentration of lines.

### ① Average

These are randomly interspersed lines that continue to the edge of the composition. They are suited toward suggesting average speeds.

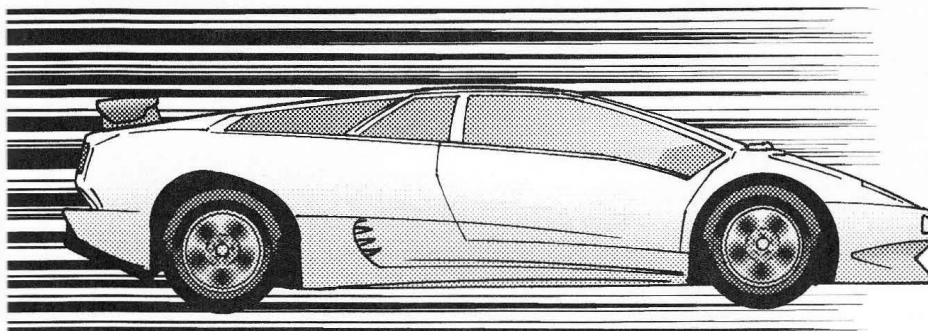
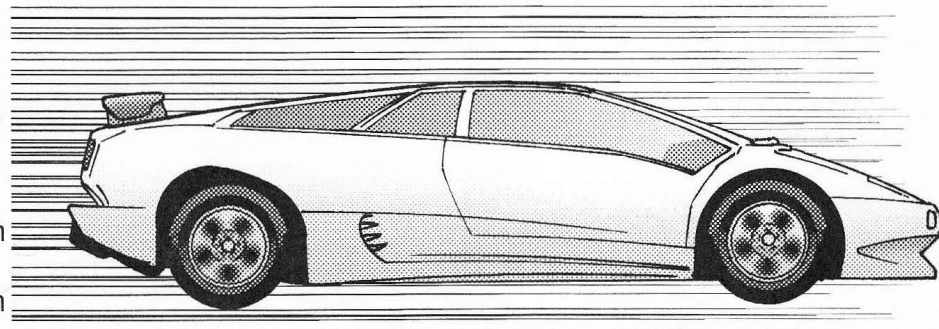


### ② Solid Lines

These are randomly interspersed lines that continue to the edge and have solid black filling in between spaces. They work well for showing high velocity race scenes, etc.

### ③ Tapered Lines

These are randomly interspersed lines that taper either to the right or left. They work well for suggesting acceleration or deceleration. For the former, have the lines taper in the same direction as the car (see right fig.). For the latter or for sudden braking, have the lines taper in the opposite direction as the car.



### ④ Fading Solid Lines

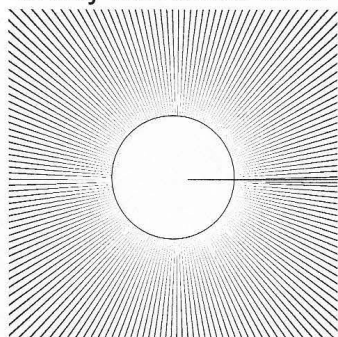
These are randomly interspersed solid lines that fade either to the left or right. They are suited toward representing sudden acceleration in that they suggest ultra fast power bursts.

## ● Special Effect Line 2: Radiating Lines

Radiating lines refer to tapered lines radiating from the panel lines toward the center. They suggest movement from the center toward the picture plane or vice versa.

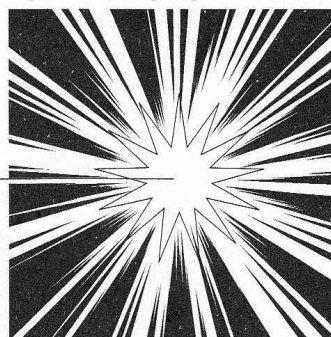
### How the Lines Taper Determines the Effect

Evenly Distributed Lines



Having the lines taper toward the center, forming a circle results in pleasingly formed, evenly distributed lines.

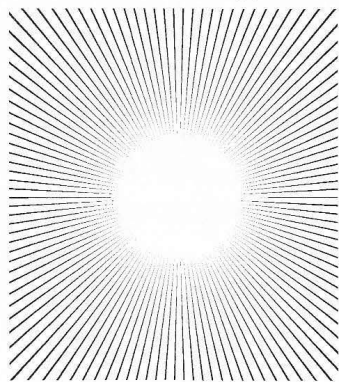
Sporadically Spaced Lines



Having the lines taper toward a star-shaped center suggests speed.

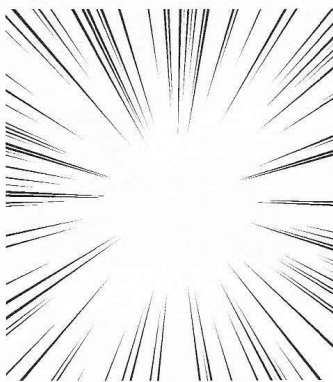
White

### Four Common Types of Radiating Lines



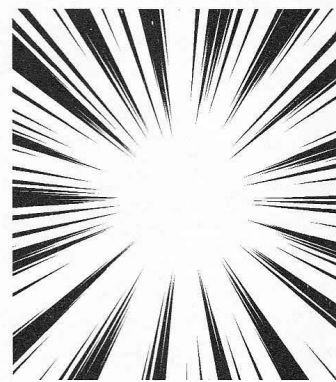
Evenly distributed lines

These are evenly spaced lines. Modifying the spacing width changes the sense of movement.



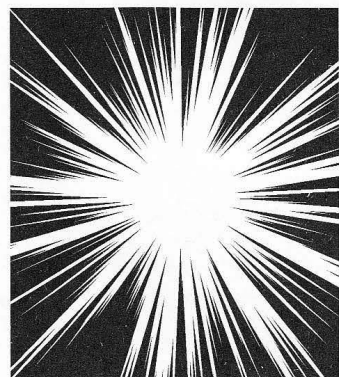
Sporadically spaced lines

These are irregularly spaced lines, which have a greater impact than evenly spaced lines.



Solid spacing

Here, solid blacks have been added in between sporadically spaced lines, producing a more dramatic effect.



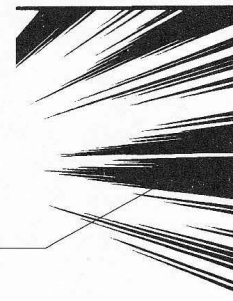
**Burst effect on black ground**  
Creating a burst effect on black ground delivers an electrifying impact.

### Creating Special Effect Lines Combined with Black



Drawing the lines, tighten the space in between to form triangles.

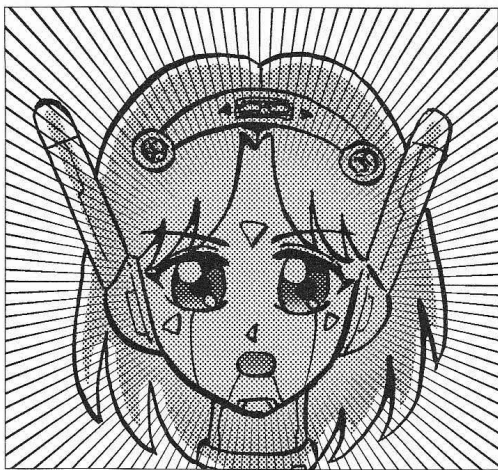
Fill in with black.



Draw lines toward the center, creating wedge-shaped forms. The trick at this point is to tighten the space in between adjacent lines so that they touch.

To finish, fill in the triangular spaces with ink or a magic marker. To create a burst effect on solid ground, simply connect the wedge-shapes.

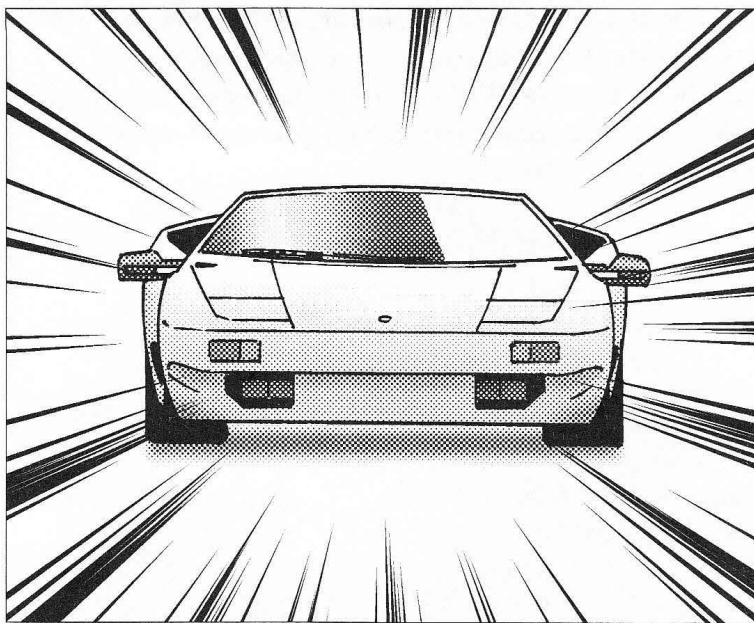




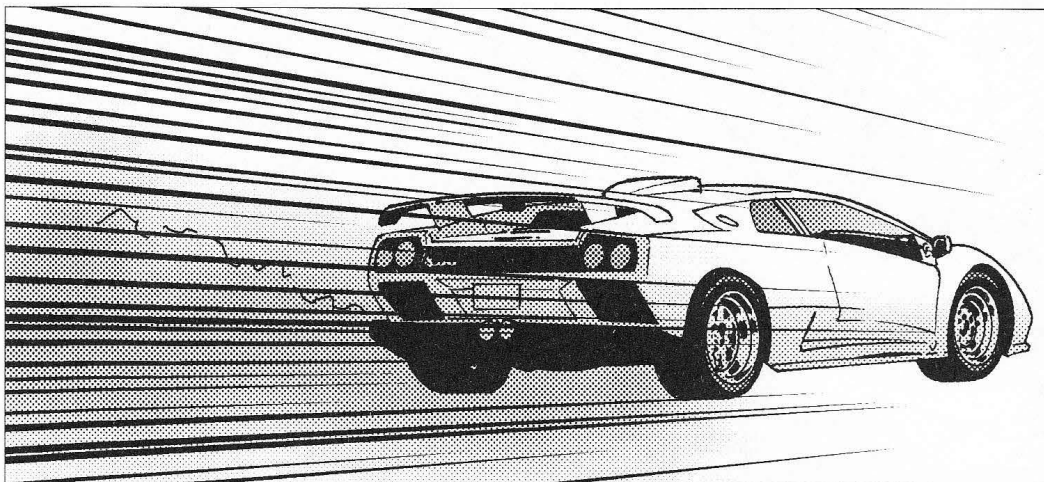
Evenly distributed radiating lines are not only effective for suggesting speed but also for capturing a fleeting facial expression.

### Expanded Version

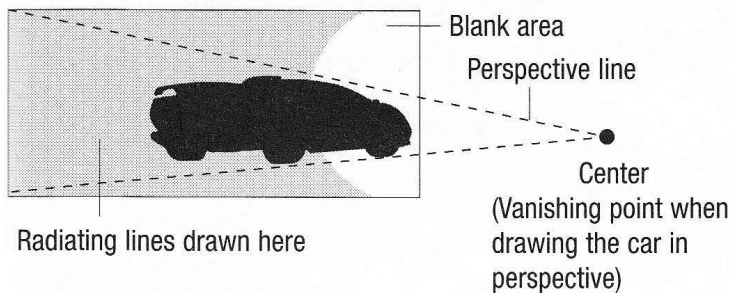
Here, the center (vanishing point) is positioned somewhere outside the panel's lines, expanding the composition beyond its boundaries.



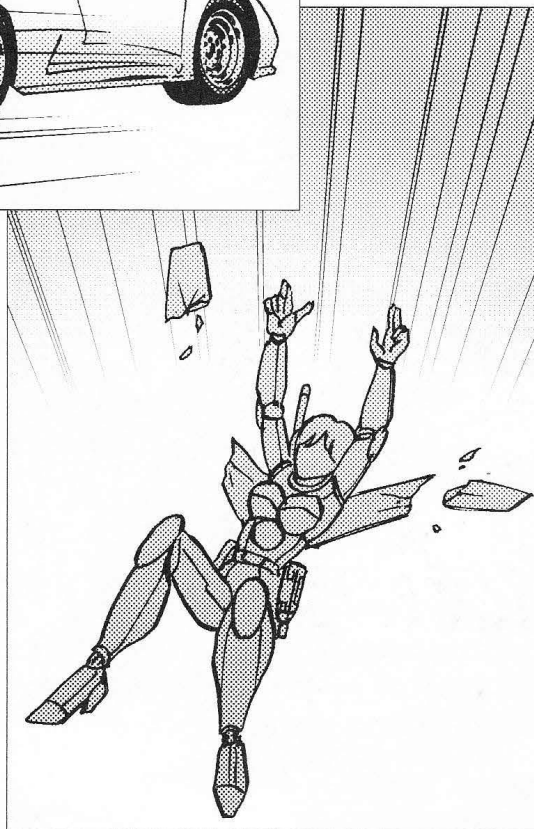
Sporadically spaced radiating lines are used to show movement toward or away from the viewer.



When drawing a car or airplane in perspective, positioning the center outside the panel's lines creates the impression of passing another vehicle.



When depicting a falling or floating motion, position the center somewhere above or below the panel and lightly add in the lines.

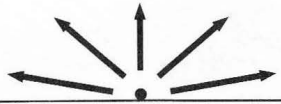




## Depicting the Moment of or After an Explosion

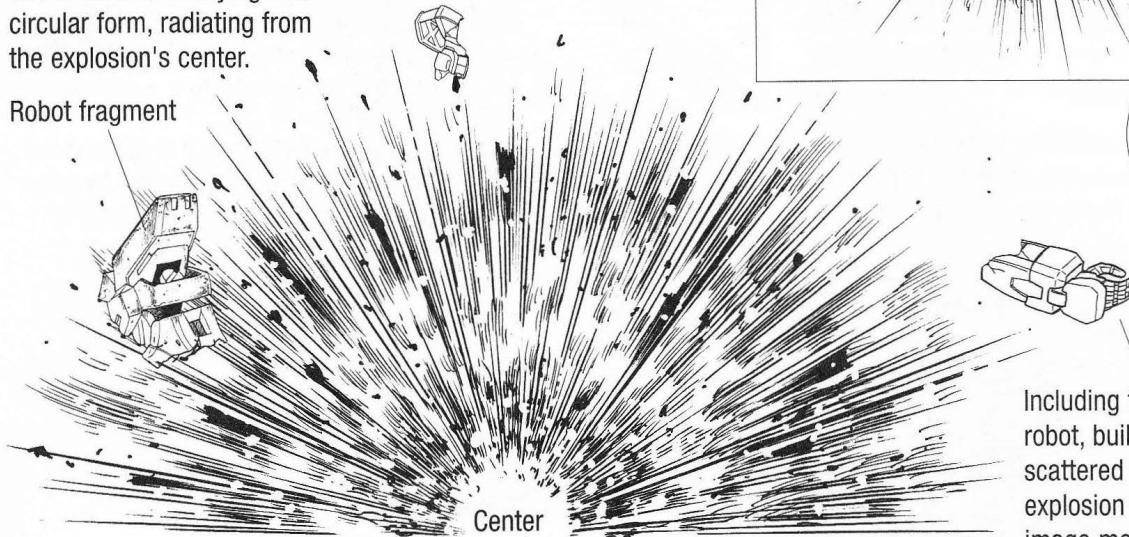
The forms taken by explosions can be roughly divided into the moment that the explosion occurs and immediately after. In addition, including debris of the object(s) blown apart results in a more convincing picture.

### Ground Explosion



Show debris sent flying in a circular form, radiating from the explosion's center.

Robot fragment

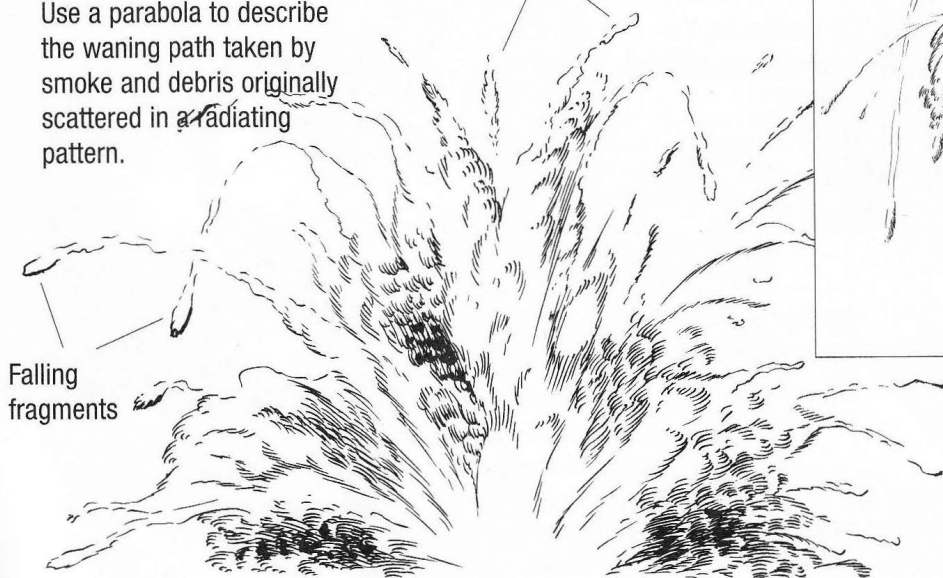


### Moment After a Ground Explosion

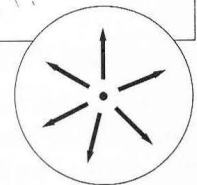
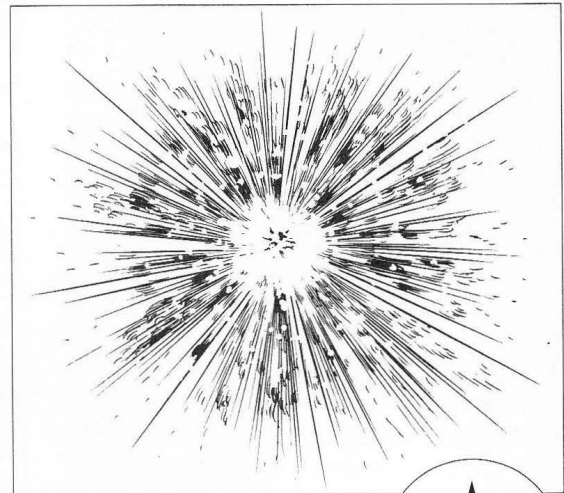


Use a parabola to describe the waning path taken by smoke and debris originally scattered in a radiating pattern.

Scattering fragments

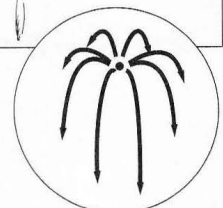


### Midair Explosion



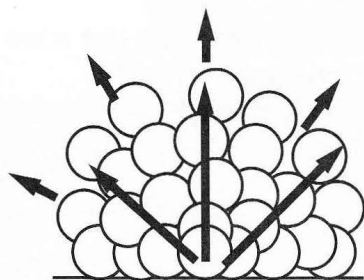
Including fragments of a robot, building, etc. sent scattered from the explosion makes the image more authentic.

### Moment After a Midair Explosion



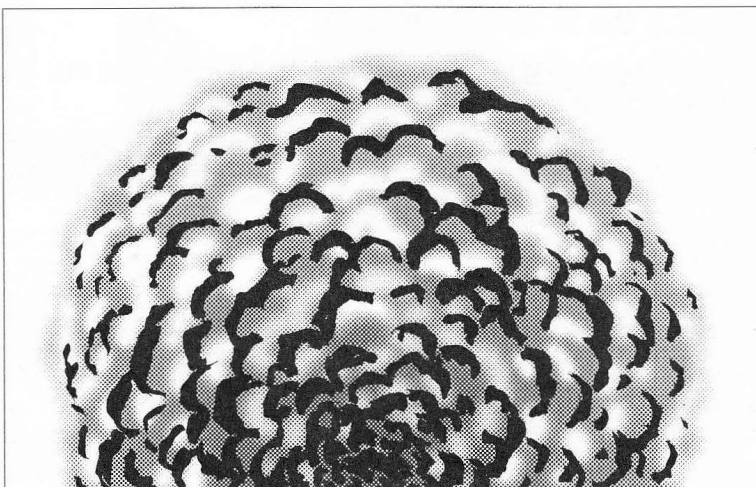
# Representing Billowing Smoke and Airflow

Now let's look at how to draw black smoke expanding after an explosion and how it is carried by the wind.



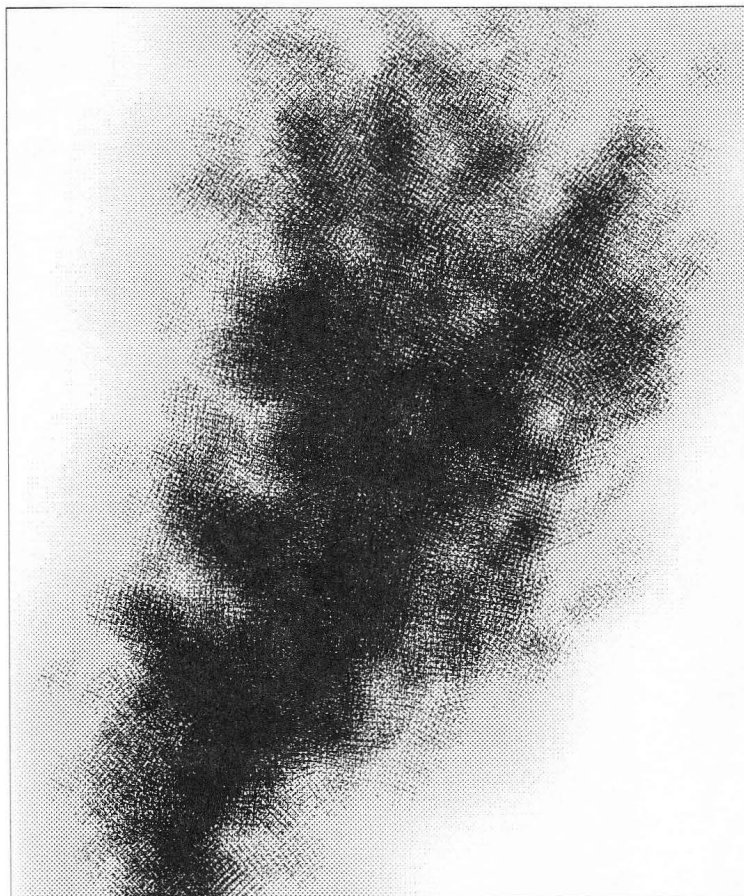
Draw surging masses of smoke as individual spheres. Use solid black for shadows resulting from a light source located in the center.

## Depicting Billowing Smoke

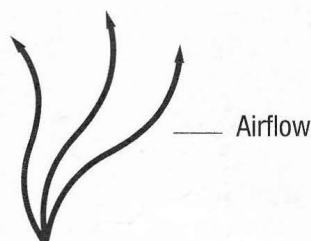


Use solid black and etched dark screen tone for shadows occurring on the billowing smoke.

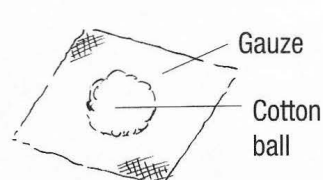
## Depicting Black Smoke While Keeping Airflow in Mind



To create black smoke being carried in the wind, dab the gauze onto the drawing according to how the wind should flow. Attach a light screen tone that is slightly larger than the target area and etch, blurring the perimeter.



## Using Gauze

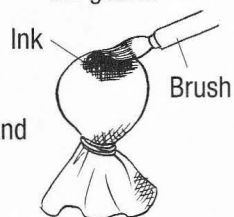


① Use a 10-cm. (approx. 3 7/8") square of gauze and a 2-cm (approx. 3/4") cotton ball.

② Wrap the cotton ball inside the gauze.



Rubber band



Ink

Brush

③ Close the bundle with a rubber band to finish.

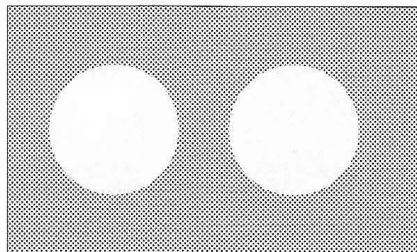
④ Using a brush, allow ink to soak into the gauze and then dab the gauze onto the drawing, rotating the gauze as you work.

## Using Screen Tones to Depict Light

There is light other than that from the sun. There are car lights, lamps lighting a robot's eyes, and rocket flames: each light is different. Representation also changes according to the situation.

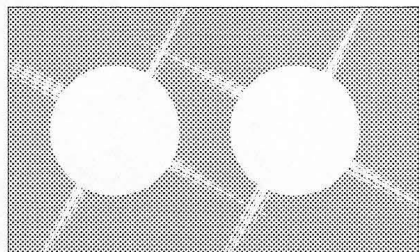
### Matching the Situation: Car Lights

Car stopped or moving quietly-scene without much movement



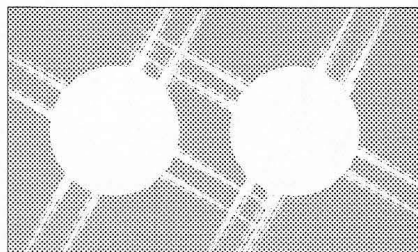
Simply cut round holes into a sheet of tone to suggest a motionless car.

Typical driving scene with a moderate sense of speed



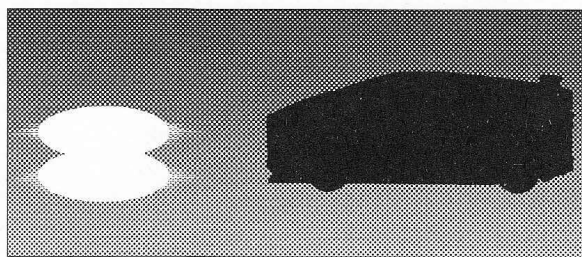
Etch an X through each "light": with a craft knife to indicate movement.

Car chase or race scene-high action and fast paced movement

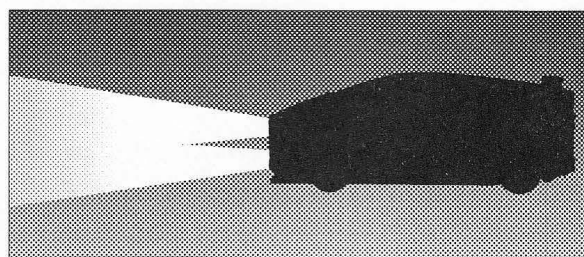


Etch the exterior of the circles (lights) in a radiating pattern. Also, etch a double-lined X through each light to intensify the sense of speed.

### Overhead, Oblique View



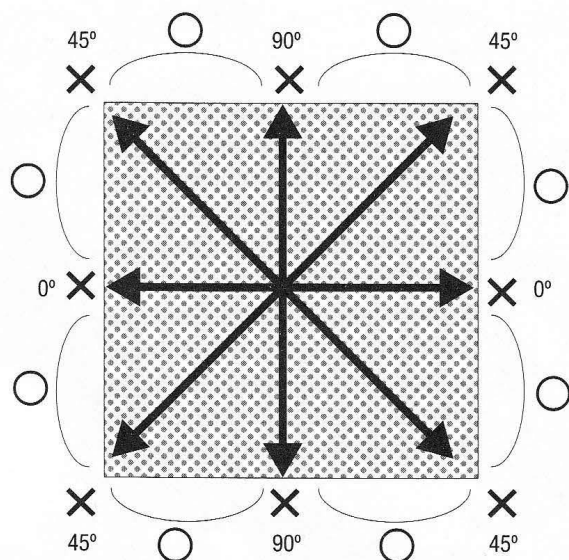
Low beams shine on the road in front of the car. Cut circles in the screen tone somewhere in front of the car and lightly etch the front and back of the circles.



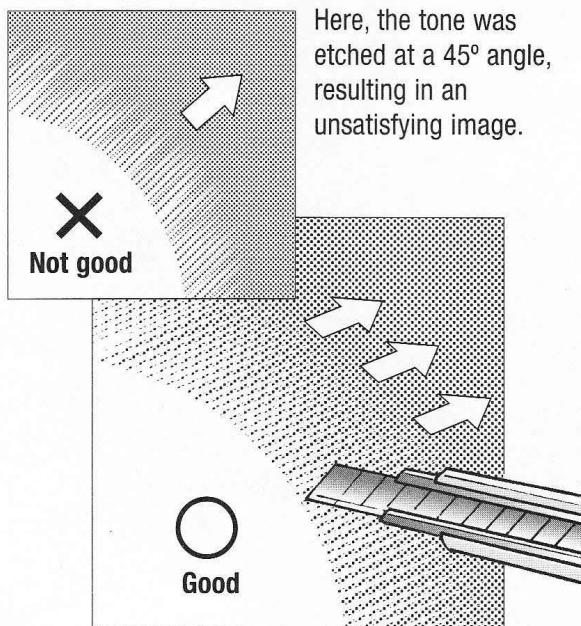
High beams shine off to a distance. Cut the tone in fan shapes originating from the car's headlights and add light gradation tone.

### Etching Tone

Angles to Avoid When Etching Tone



A tone's dots are aligned at 0° (horizontally), 45°, and 90° (vertically). Consequently, etching at these angles will result in an awkward-looking product.

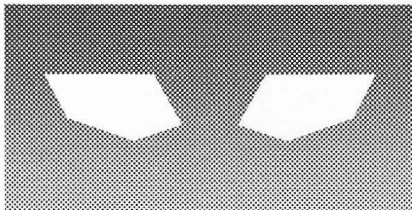


Etching between those angles (not marked with an X) will result in pleasing tone work.



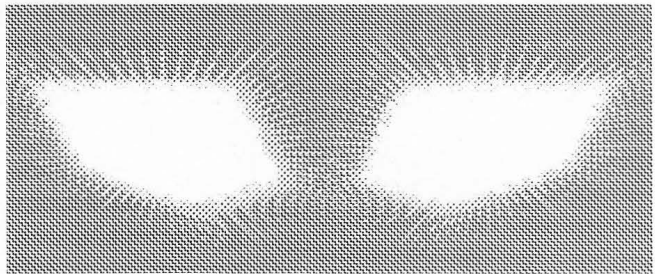
## Depicting Lights for Robot Eyes

Normal Mode



When not showing movement, simply cut the tone in the shape of the eyes.

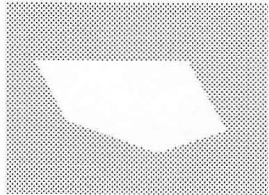
Bright Mode



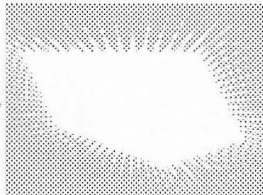
When the eyes shine brightly or for any other scene with movement or impact, use two layered sheets of tone.

### Layered Tone

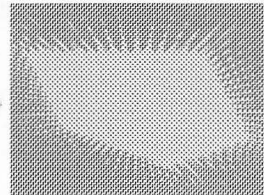
The Process



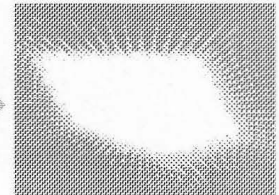
① Etch the tone according to the eye's shape.



② Etch in a radiating fashion away from the eye.



③ Superimpose another sheet of the same tone, shifting it slightly to adjust the darkness (value).



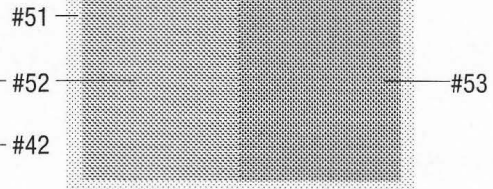
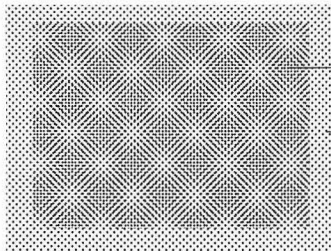
④ Etch around the eye's silhouette, blurring the edges. Cut out the inside to finish.

#### Attention!

Be sure to use screen tones from the 50's series. If you fail to use tone with the same number of lines, a moiré effect will result, which will not look nice. As long as the number of lines are identical, a moiré effect can be prevented despite differing values (dot size / density).

#### Layered Different Types of Tones

Here, we see a moiré effect.



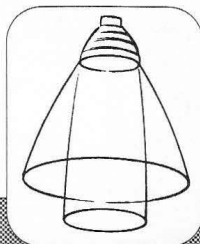
#### Layered Similar Types of Tones

Since the number of lines is identical, a moiré effect does not result, even though the tones have different values.

- Make sure to use screen tones with the same number of lines to avoid a moiré effect.

## Depicting the Light from a Blast of Flames

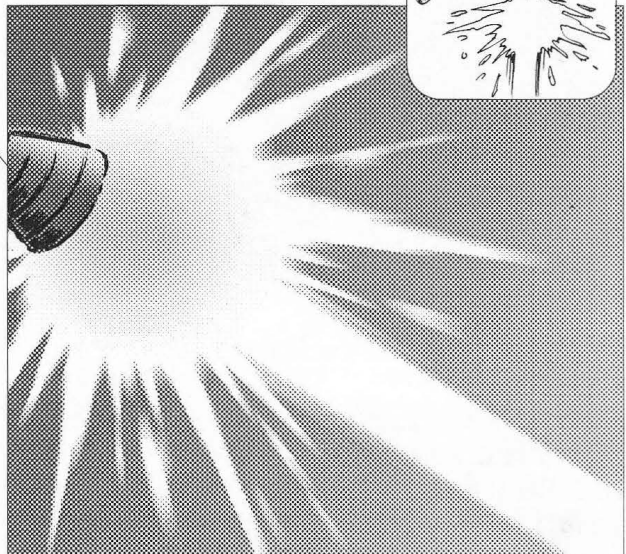
Use layered tone to render the flames erupting from a rocket engine nozzle. This will give the image depth. Rather than merely cutting the tone, etch the target shape using a craft knife, blurring the edges. This will give you a light with a natural feel.



Rocket engine nozzle



Being imaginative and modeling the rocket blast after the moment water spurts from a spigot will give the effect of light softening after it blasts from the nozzle.



Note: Moiré effect occurs when screen tone dots interfere with one another, resulting in a pattern.



## Give It a Bang with Lettering

Display lettering gives the final touches to the artwork. Add lettering that matches the scene as a sound effect. This will make the reader feel he or she is really there and give the scene greater depth.

### Types of Display Lettering



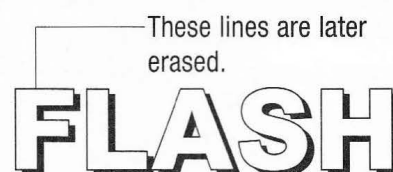
#### Explosions

Having one set overlap the other like a concentric circle makes the lettering appear to be blown debris, giving a sense of reality. Furthermore, I intentionally extended the lettering beyond the panel to give the entire composition the feel of an expanding explosion.



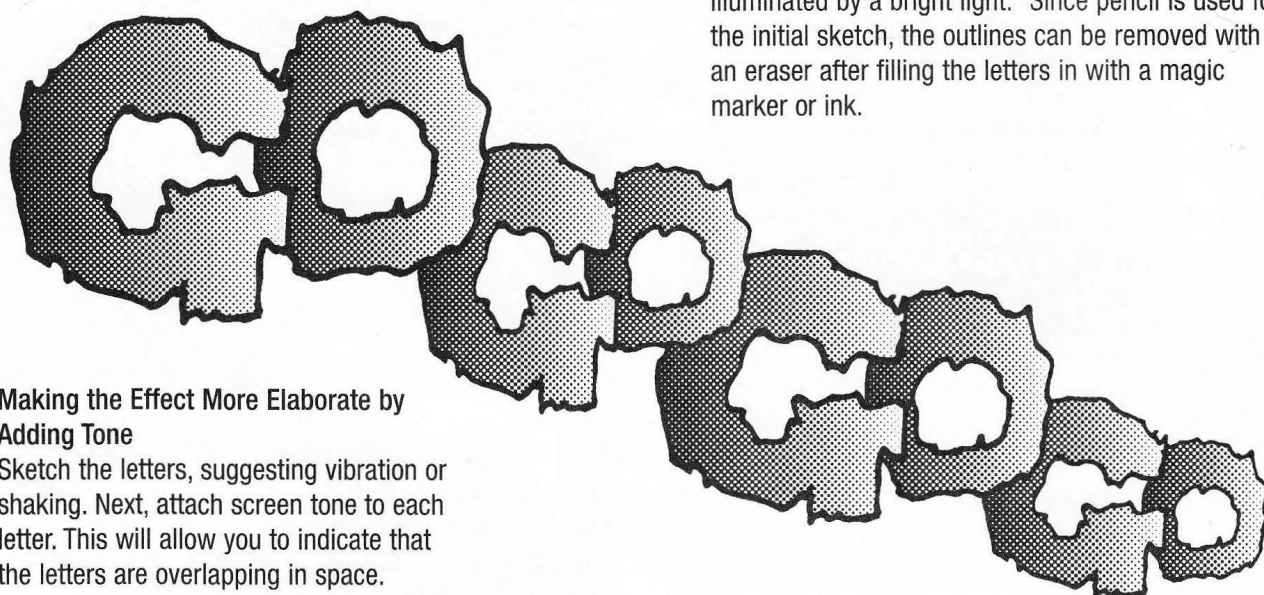
#### Lettering with Perspective

Drawing sound effect lettering in perspective and extending beyond the panel gives the whole panel depth. Moreover, it also causes the viewer to imagine that something happened somewhere outside the panel.



#### Using a Shadow Effect to Create Contrast

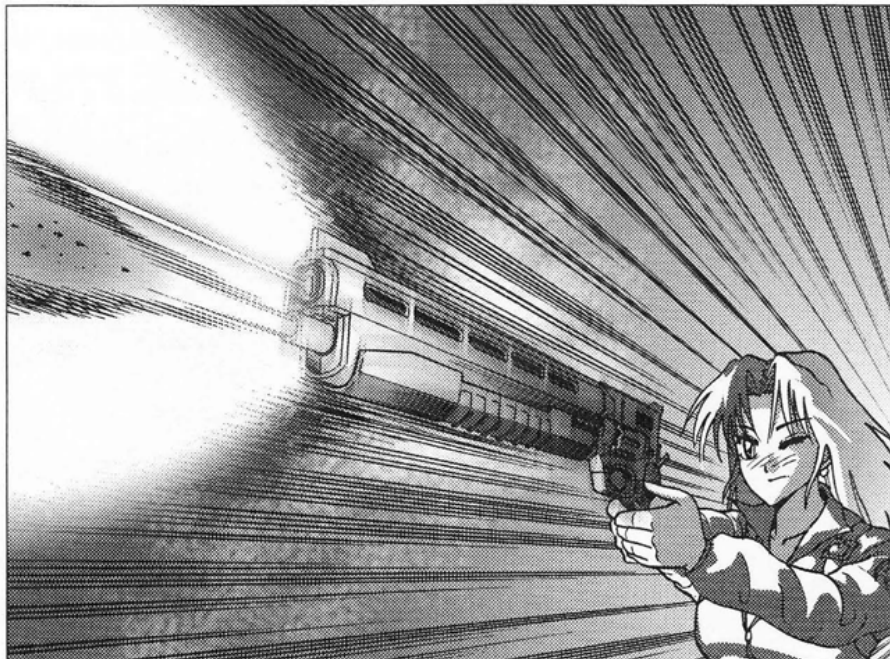
Give open letters a shadow effect and then erase their original outlines. This creates the effect of being illuminated by a bright light. \*Since pencil is used for the initial sketch, the outlines can be removed with an eraser after filling the letters in with a magic marker or ink.



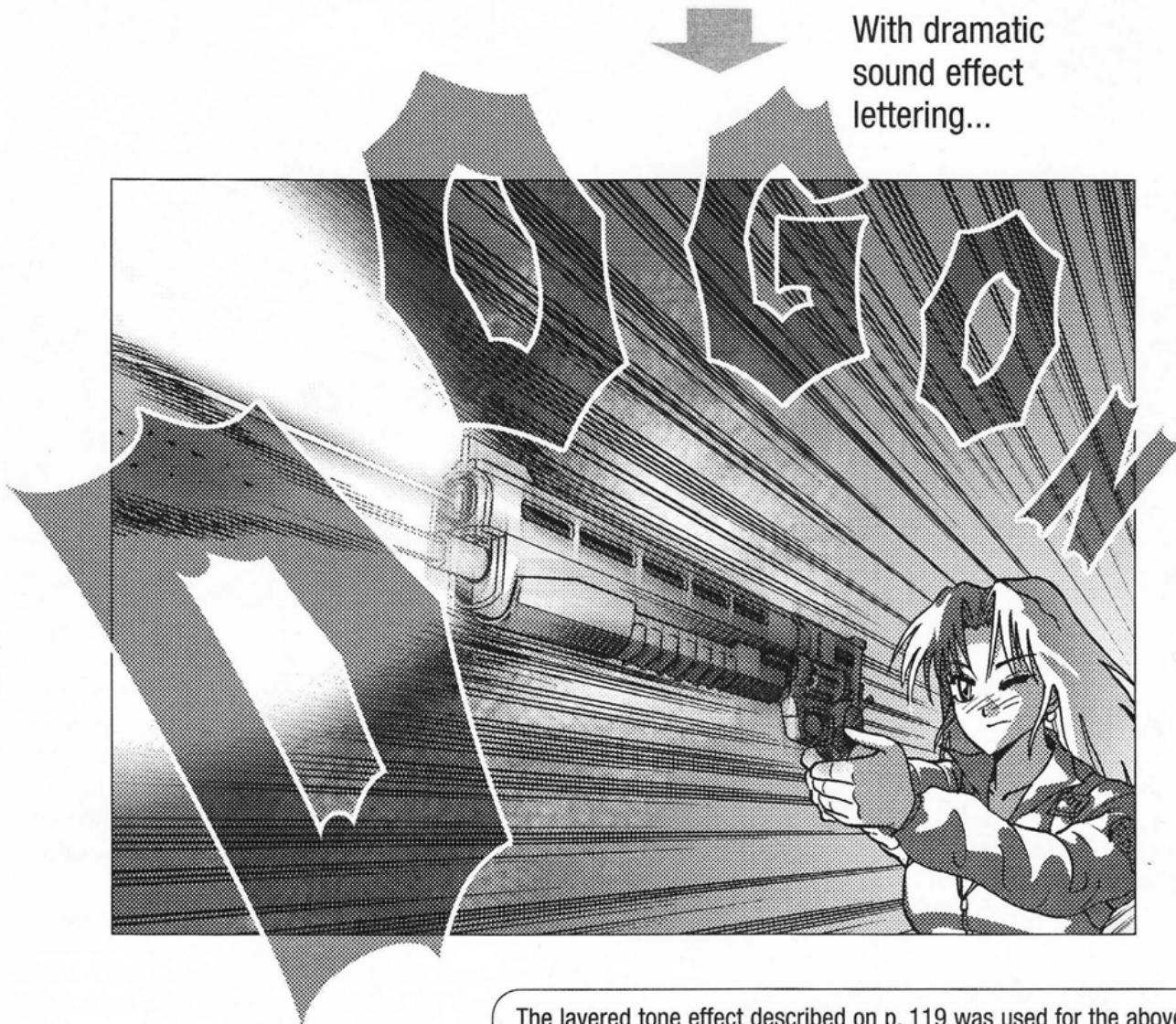
#### Making the Effect More Elaborate by Adding Tone

Sketch the letters, suggesting vibration or shaking. Next, attach screen tone to each letter. This will allow you to indicate that the letters are overlapping in space.

Here is a panel with special effect lines and screen tone.



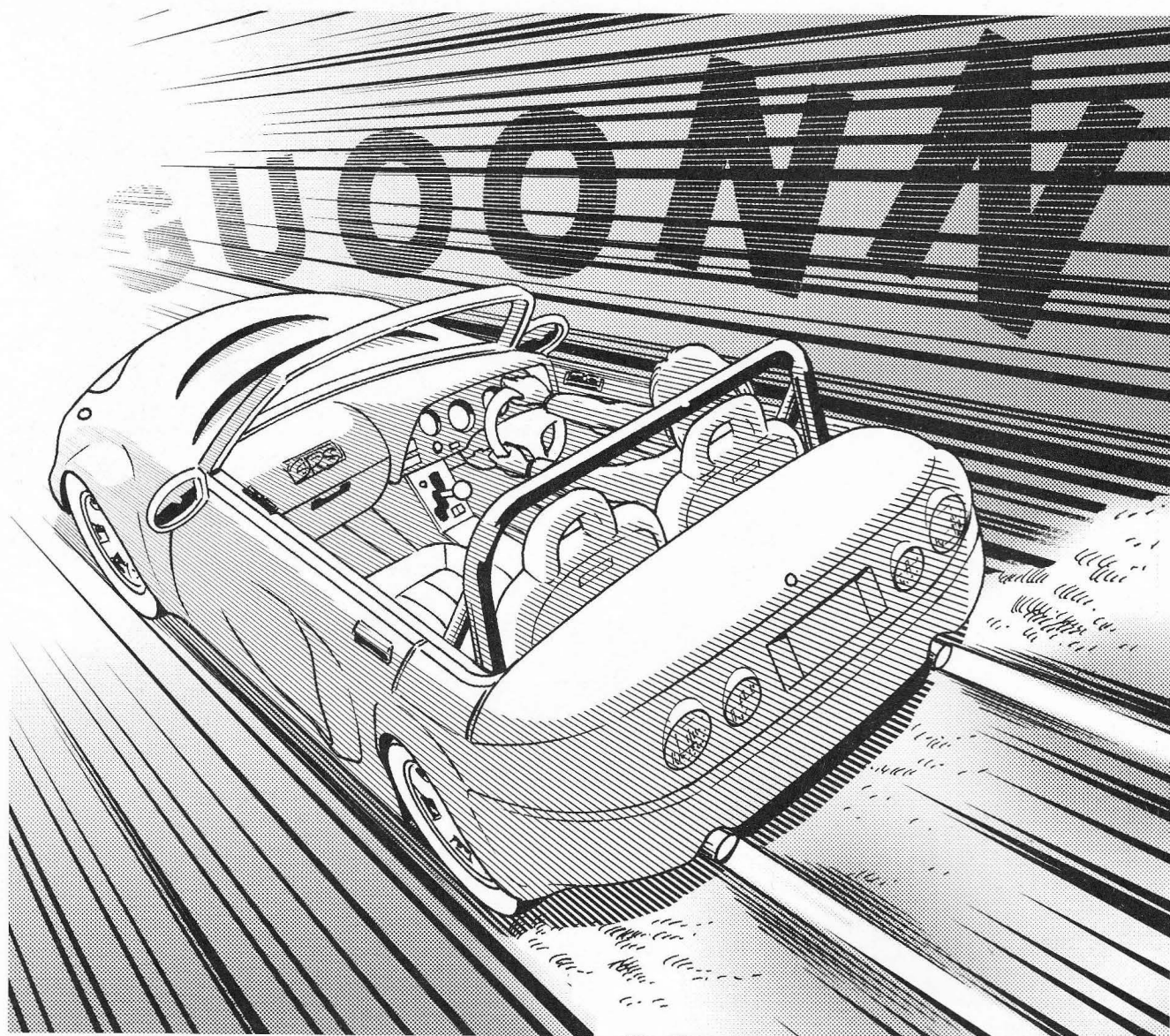
With dramatic sound effect lettering...



Now the panel has visual impact.

The layered tone effect described on p. 119 was used for the above lettering. Here, screen tone of a similar type to that used in the background was cut in the shapes of the letters and attached over the original tone. The letters were then outlined in white. Because the special effect lines are still visible through the lettering with the layered tone, the sense of speed is not lost.



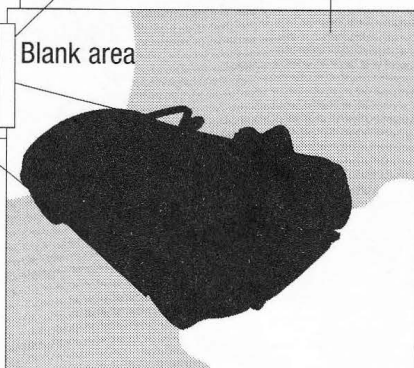


Vanishing point  
(Thumb tack)

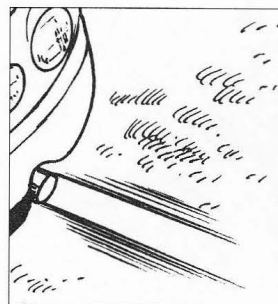
Additional  
piece of paper

Masking tape Target area for radiating lines

Blank area



Stick a thumbtack at the vanishing point (see right fig.) and lay out where the special effect lines will go. Draw the background radiating lines. Also, if the vanishing point is located off the original paper, use another sheet, attaching it to the first with masking tape.



Using hatching for smoke at the tail and straight lines for the exhaust coming out of the tailpipe generates a sense of speed.

#### Tip

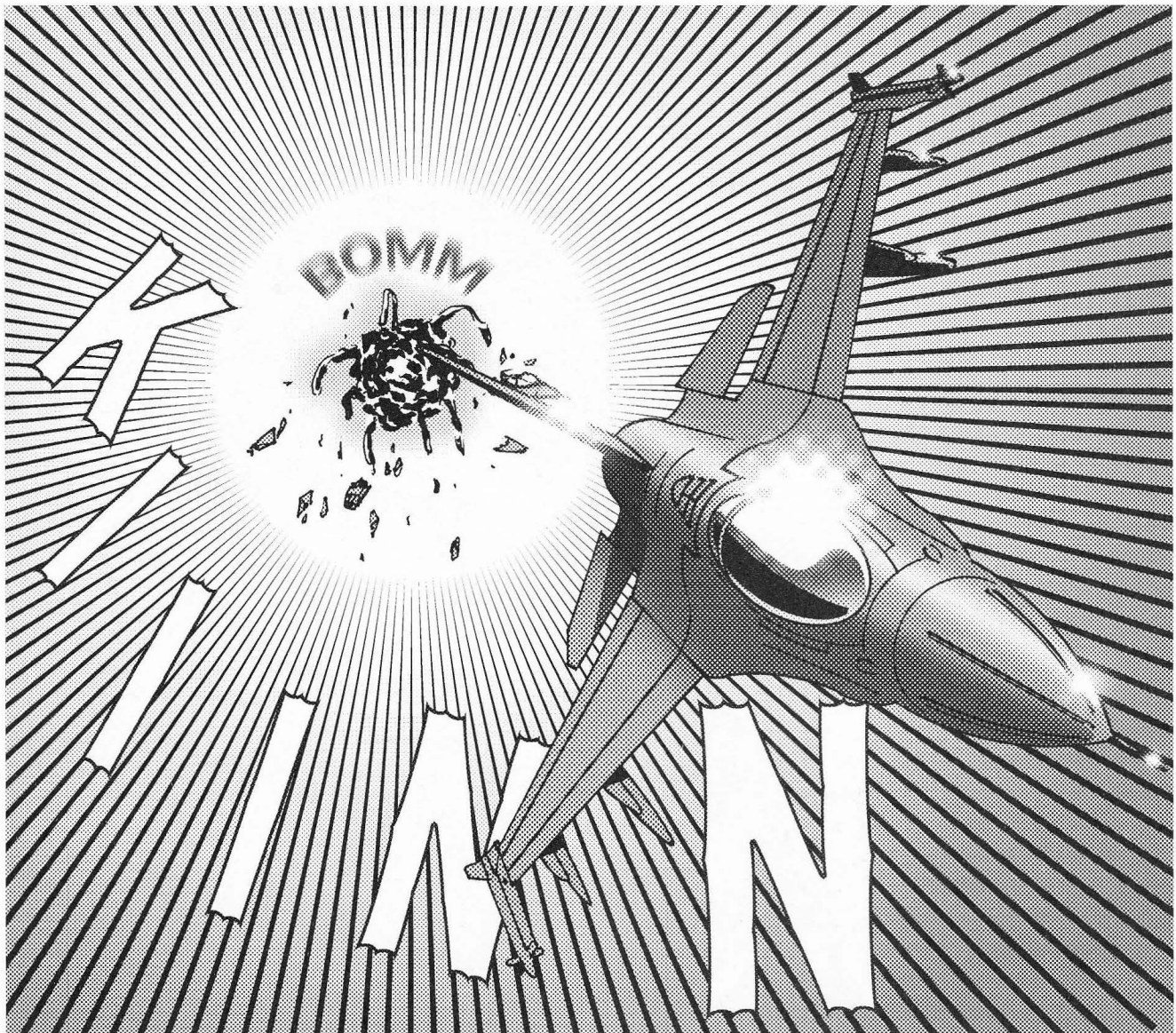
Adding special effect lines to the car itself will enhance the sense of speed even further. Use fine, even lines for the car's shadows, attaining the appropriate shading. This will balance the car with the background, while simultaneously giving the car senses of both volume and speed.

**SUONNN**

Add sound effect lettering to develop the feel of swiftness.

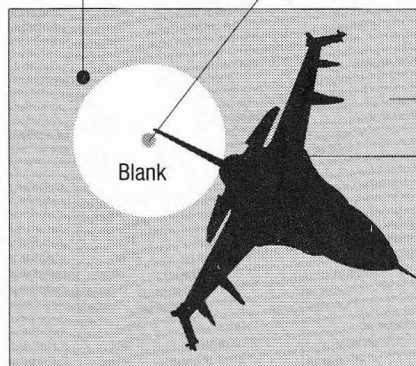
## Sample 2

A Fighter Jet Leaving the Scene After  
Destroying an Enemy Plane



Vanishing point for  
fighter jet

Radiating lines' center  
(Thumbtack)



Area for radiating lines

Mask the fighter jet

For the above scene, position the radiating lines' center at the explosion's core instead of the fighter jet's. The viewer's eye is drawn to the explosion, making it obvious that fire from the fighter jet in the foreground caused the explosion. Mask the fighter jet with masking film, etc. before drawing the lines to protect the jet.

Etch around the outside of the lit area of the canopy to suggest brightly reflected light. This adds dynamism to the fighter jet.



Adding debris from the destroyed enemy plane around the explosion illustrates that the scene is directly after the attack.

Use large-dot 50's series tone for the fighter jet and fine-dot 60's series for the background. The screen tone evokes a sense of depth.





**Sample 3**

A Space Shuttle Hurling toward a Space  
Station About to Explode

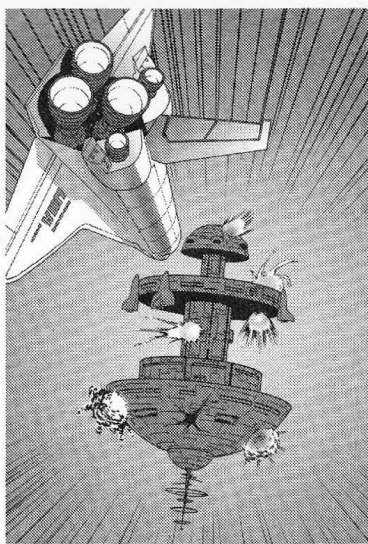


① Use radiating lines to gain a sense of speed



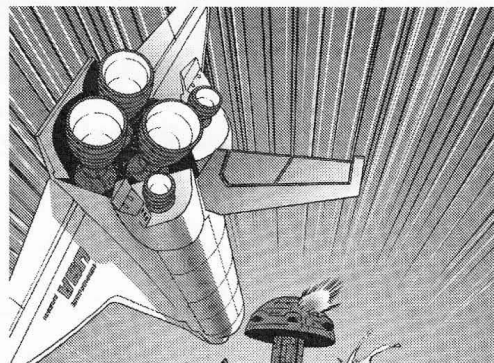
Attach a thumbtack to the station's center. Cover the shuttle with masking film, etc. Touching the end of a straightedge to the thumbtack, draw sporadically spaced radiating lines to attain a sense of velocity.

② Use different tones to achieve depth



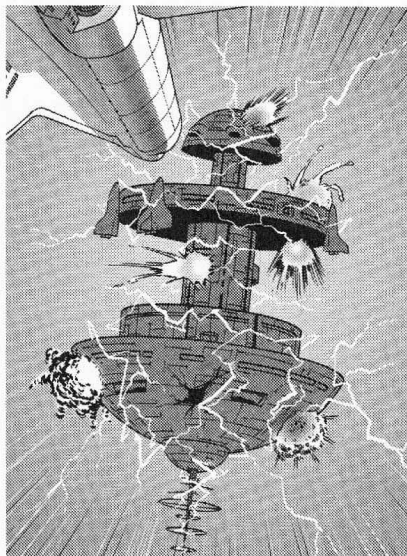
Use 60's series gradation tone for the background, 50's series for the station, and 40's series for the shuttle. The differentiated use of tone will give the image depth. This will make the overall composition dark, so add highlights to the shuttle to balance the contrast between the light and dark areas.

③ Gain depth using doubled radiating lines



Etch the background tone with a craft knife to create white radiating lines. This will add to the sense of speed.  
\*See note below for information on etching radiating lines with a knife.

④ Suggest the moment before an explosion by adding "electrical discharge"



Draw lightning bolts around the space station in white correction fluid using a spoon pen. The addition of the modulated, dynamic lines gives the impression of the station moments before exploding.

⑤ Breathe life into the shuttle



To suggest blasting flames, apply white to the thruster nozzles using either gauze or an airbrush. This adds a sense of tension. If you are using an airbrush, loosen the needle, enlarging the paint droplets. See p. 117 for information on how to use gauze.

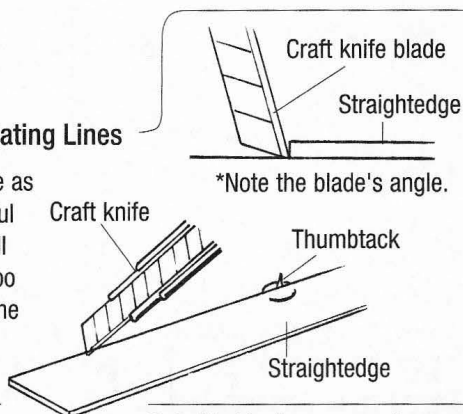
⑥ Add special effect lettering to impart a sense of being there



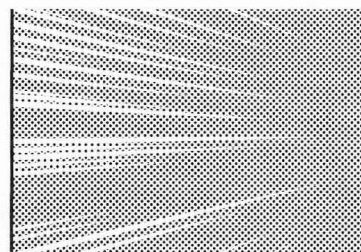
To finish, add white shadowed lettering for sound effects near the explosions. This will make the scene feel more real.

### Using a Craft Knife to Create Radiating Lines

Slide the craft knife along the straightedge as you would a pen. (See right fig.) Pay careful attention to the knife's angle. Also, you will not be able to etch the tone if you press too lightly, while if you press too much, the tone will rip.



\*Note the blade's angle.



Etched radiating lines

Note: Masking is necessary, because it eliminates the need to touch up with correction fluid after drawing the lines.



# Appendix

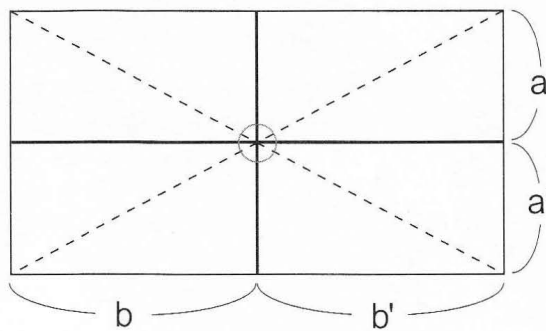
## Plotting out the Perspective Base Map

Drawing in perspective requires that you determine the center point. The center can be easily determined by dividing the initial box into two or three equal parts.

----- Diagonal line      ——— Divisor line  
 - - - - - Center line      ○ Intersection

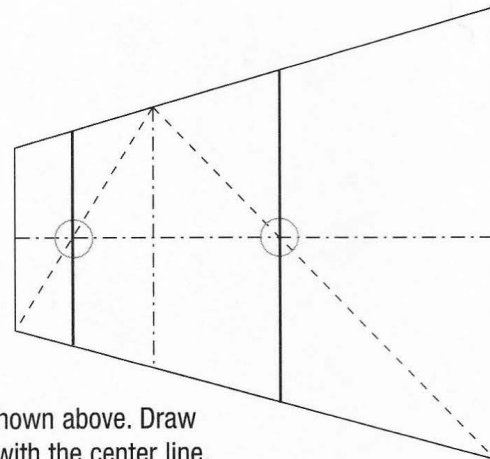
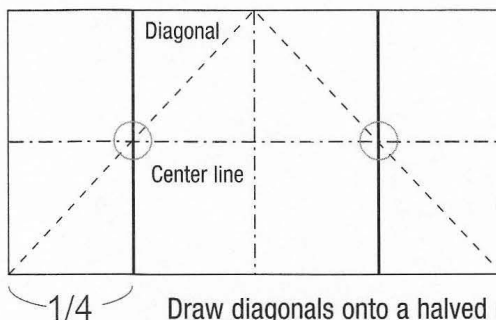
## A Rectangle in Perspective

### 1/2 Division



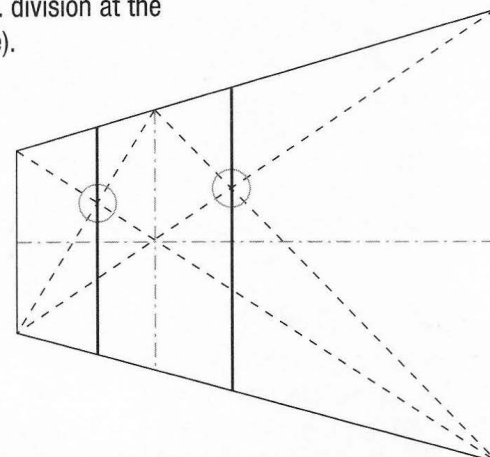
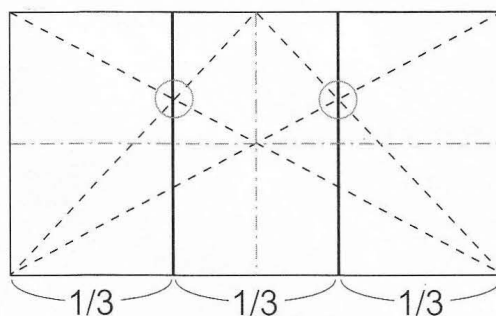
Drawing cross diagonals divides the rectangle into half vertically and horizontally.

### 1/4 Division



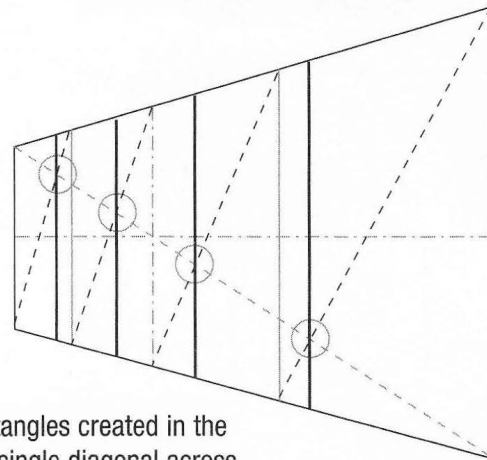
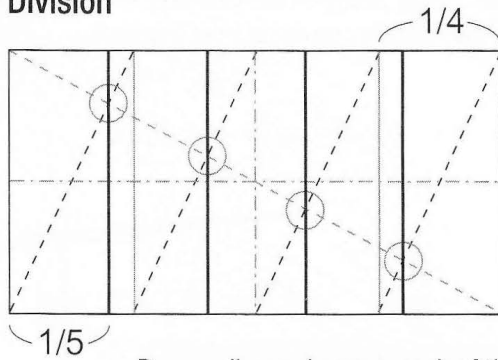
Draw diagonals onto a halved rectangle as shown above. Draw a vertical line where the diagonals intersect with the center line, dividing the rectangle into four. The rectangle can be divided into eight parts using this same principle (i.e. division at the intersections of the diagonals and center line).

### 1/3 Division



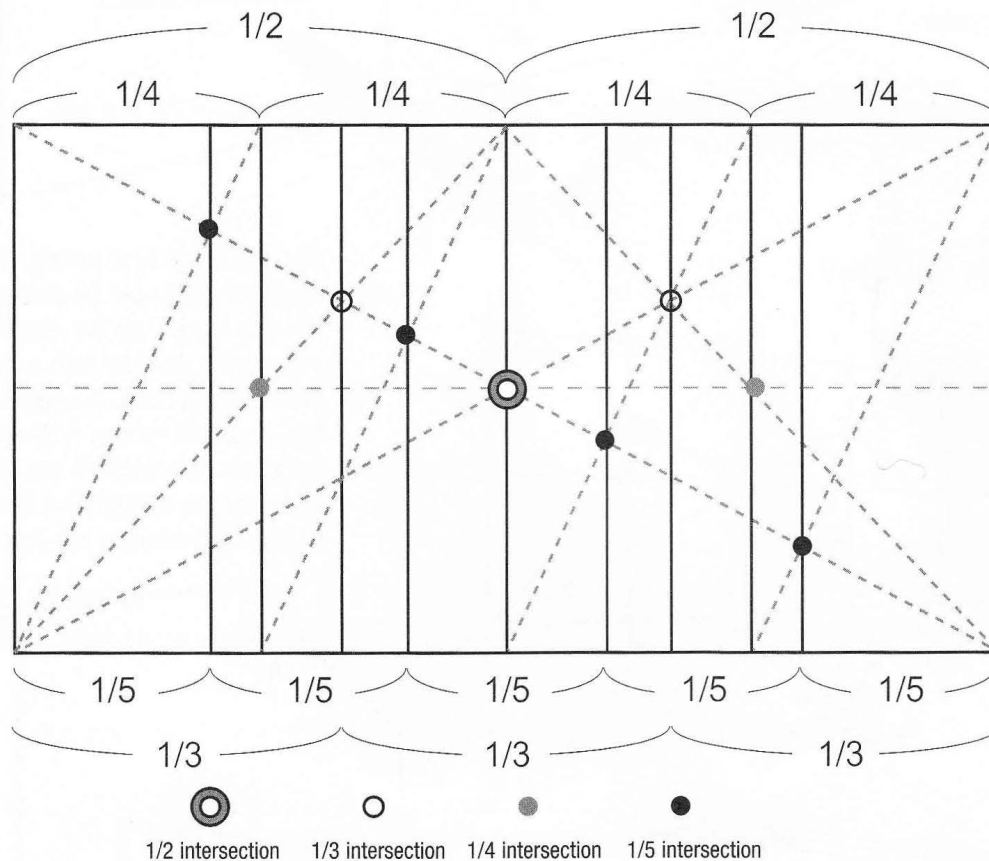
Drawing both diagonals for halving and for quartering the rectangle allows you easily to divide the rectangle into three parts. Applying the techniques for dividing into halves or thirds to this rectangle yet again allows you easily to create six or nine equal parts.

## 1/5 Division



Draw a diagonal across each of the sub-rectangles created in the foregoing quartered rectangle. Next, draw a single diagonal across the entire rectangle and then a vertical line where each of these diagonals intersects. This will divide the original into five parts.

## Summary



I highly recommend mastering these techniques, because they will allow you to divide up almost any object.

These techniques have broad applications and can be used to draw the windows of a house or to determine how many "tire lengths" a car is. Even seemingly difficult perspectives can be made easy to understand if you are familiar with these techniques. Please also note that these techniques can be grouped as shown to the right.

### • 1/2 Division Group:

- 1/2 Division
- 1/4 Division
- 1/8 Division

### • 1/3 Division Group:

- 1/3 Division
- 1/6 Division (When combined with the 1/2 division technique)
- 1/9 Division

### • 1/5 Division Group:

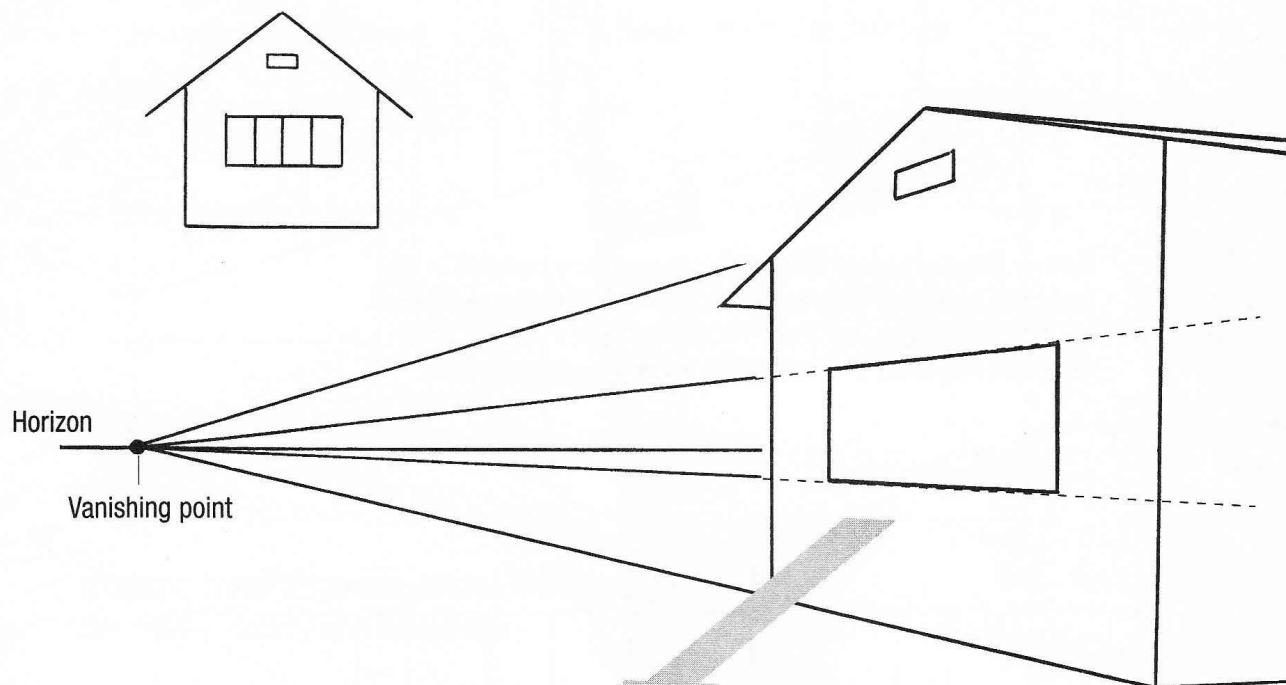
- 1/7 Division



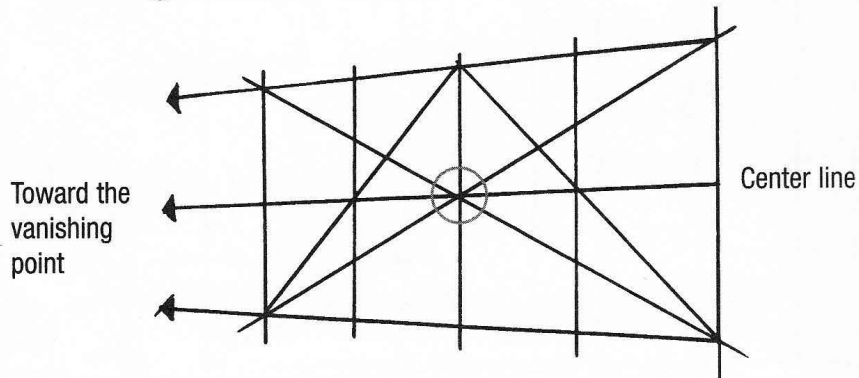
## Sample Drawings

Let's use the 1/4 division technique to create four windows in perspective.

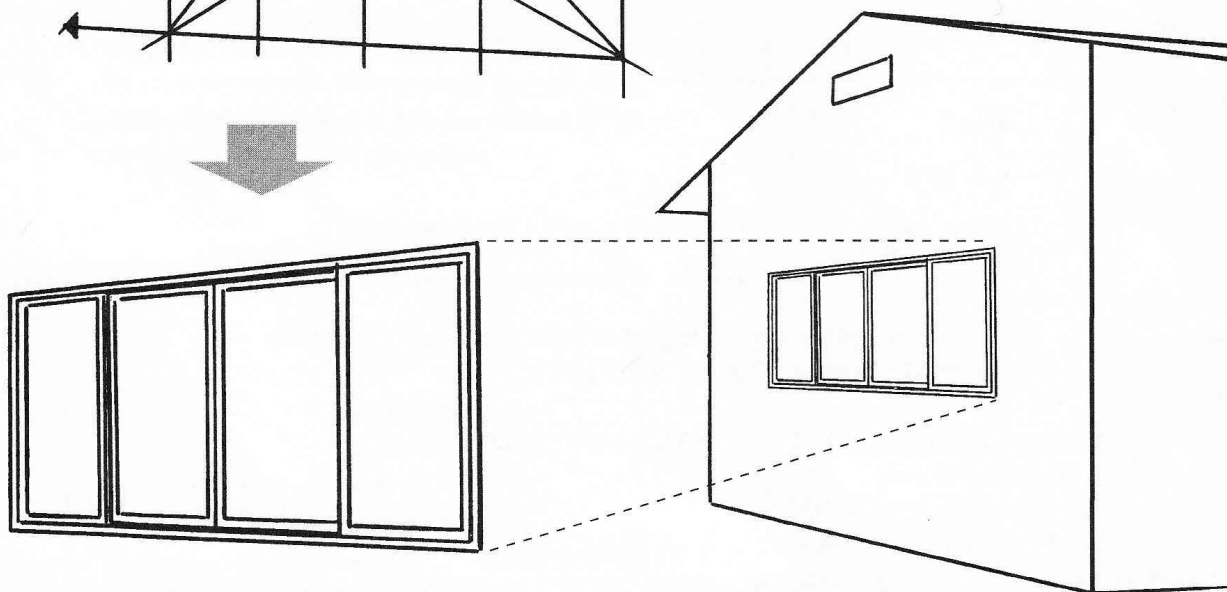
The house may look fine if you simply draw the windows as you think fit. But, once you are done, you may later find yourself thinking, "Oops! I made the far window bigger than the near one." Such mistakes are common. Try avoiding this by drawing the windows correctly from the start.



### Creating Four Windows



The center line (line equally dividing the top and bottom) can be plotted by drawing a line from the diagonals' intersection (marked with a circle) toward the vanishing point. In addition, drawing two diagonals (whose vertex is above the diagonals' intersection) and then drawing a vertical line through this intersection divides the rectangle into four parts.



Add window frames to the quartered windows to finish.

Now the near window is appropriately larger than the far.

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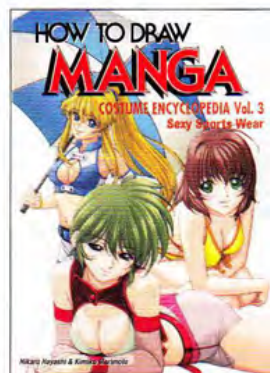
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